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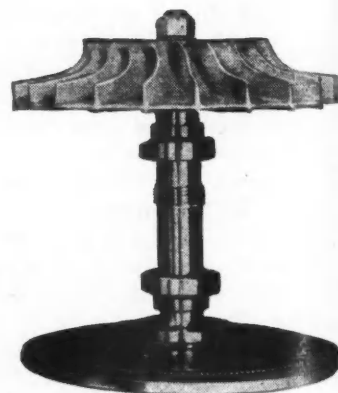
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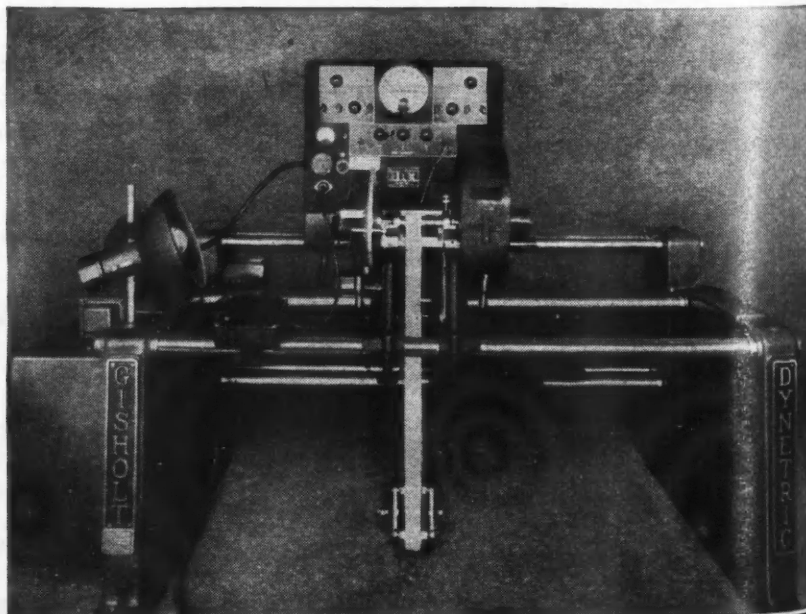
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Reconversion and Jobs

by Julian Chase

(From a program sponsored by the National Conference of Business Paper Editors
broadcast over the Mutual Network)



WE NEED many things in this country today but first we need industrial peace, enduring industrial peace based firmly, as it must be, on a widespread and deeper understanding of fundamental American economics. After that, one of the things we need most is millions of new automobiles. Estimates of our absolute requirements in that respect range from 12 to 18 millions. According to pre-war standards, our essential highway transportation vehicles are fairly well worn out. Not only that, but there are actually millions fewer motor vehicles in use than there must be if the country is to prosper to the fullest possible extent.

The average passenger car on the roads today is nearly eight years old. Before the war, the average age of cars in service was 4½ years. Today, about one car in four is more than 10 years old. In pre-war years we scrapped something like 2 million cars a year and made 3 to 4 million new ones. Since 1942 we have made no new passenger cars for civilian use and yet, in 1944, we scrapped 500,000. We need more private passenger cars. We need more trucks, buses and taxicabs and we need them now.

We need not only the products of the automotive industry, we need as badly, to swell our national income, the wages derived from the millions of jobs directly provided by that industry in all its far-flung ramifications, and by the thousands of its suppliers of raw and semi-fabricated materials.

Nearly a million and half wage earners were employed in 1939 in the manufacture, distribution and servicing of automotive products alone. Other millions of wage-paying jobs were created and maintained as a result of its demand on other industries for supplies. The automotive industry was, and will be again, by far the largest consumer of many basic materials and commodities. Of all steel produced it used 18%; of alloy steel, 55%; of malleable iron, 51%; of gasoline, 90%; of rubber, 80%; of plate glass, 75%; of nickel, 23%; of lead, 34%; of machine tools, 42% and so on through a long list of products which come from nearly all states in the union and from nearly all countries in the world.

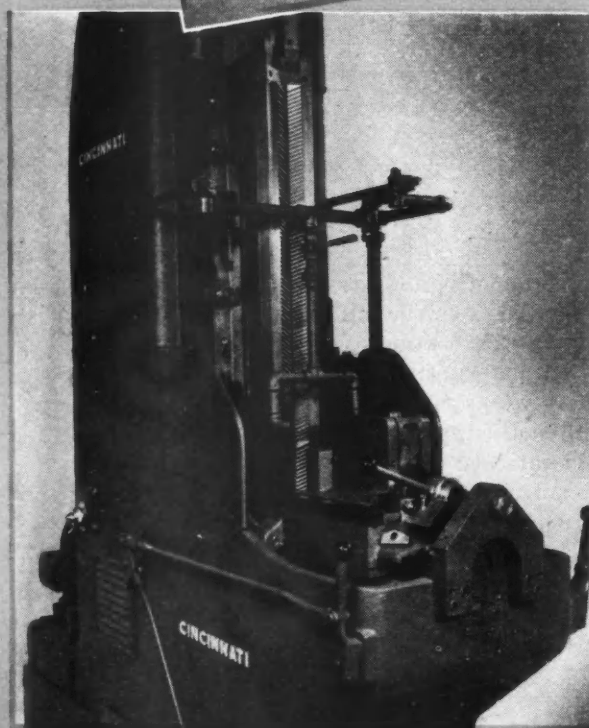
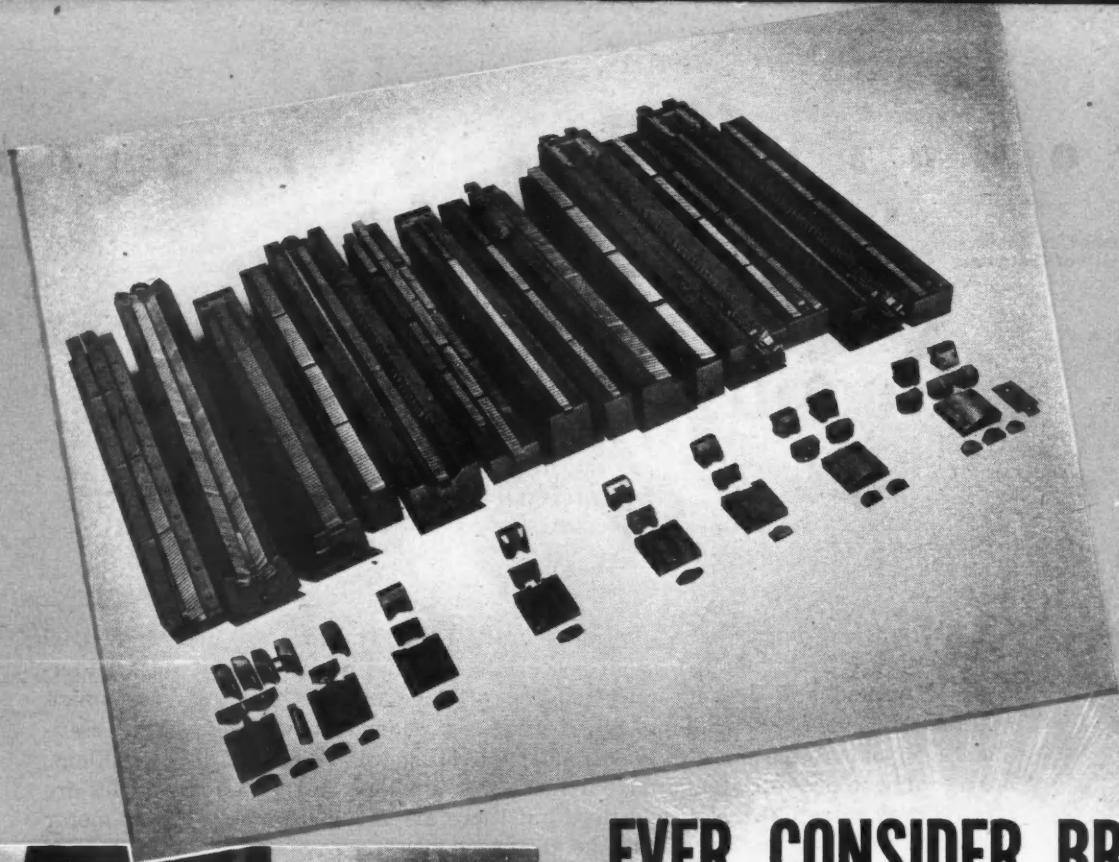
Directly and indirectly, the automotive industry provides jobs paying billions of dollars annually in wages. From it and its products each year, flow into our national and state treasuries, other billions of dollars in corporation, excise, income and special taxes. Furthermore, and with equal emphasis on its importance, it can be said that the automotive industry make a tremendous contribution to the prosperity of the country through the use of its products in essential highway transportation.

For all of us, and for the wage earner particularly, it is vitally important that the automotive industry get back into its full stride of production at the earliest possible moment.

AUTOMOTIVE INDUSTRIES

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November 1, 1945



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Name of Part . . . Washer

Material Tough Steel (AMS 6448)

Operation Several—(Broach radius, slot, offset, etc.)

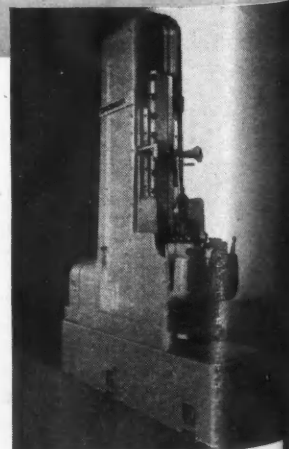
Production 91 to 167 per hour depending on operation and part

Machine CINCINNATI 5-54 Single Ram Vertical Hydro-Broach

Compare broaching with other machining methods, and we believe you will agree that it is worth serious consideration if you handle families of parts in large or small quantities. Cincinnati Application Engineers will be glad to discuss it further with you.

In the illustration at the top of this page the thirteen small parts in the front row are all surface broached on the CINCINNATI No. 5-54 Single Ram machine shown in the photograph above. Directly back of the parts in the upper photograph are the fixture support blocks used for each job. In the third row are the gages, in the fourth the clamp tips, and finally in the rear, the broach holders and inserts. ¶ Cincinnati Applica-

tion Engineers are constantly designing ingenious tools and fixtures to increase the usefulness of the broach for mass production of related parts. ¶ At the right is a CINCINNATI No. 3-48 Single Ram Vertical Hydro-Broach Machine. Complete specifications may be obtained by writing for Catalog No. M-1389. A brief description of this and other CINCINNATI Broaching Machines will be found in Sweet's Catalog File.



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Mass Production Methods and Expanded Facilities

Triple Industrial Engine Output

THE war brought a marked change in demand for internal combustion engines. In peacetime, the big production of such engines was in the passenger automobile plants, where limited numbers of models were turned out on a mass-production basis. Capacity of the producers of "industrial" engines, manufactured for sale as engines, was limited. Their plants were operated as job shops, with limited runs of many different models and variations of those models designed in most cases to fit specialized equipment rather than being offered as standard models around which equipment was designed.

It was not uncommon for the non-captive engine producers to offer as many as 20 or 30 basic engine models, each with the alternative of four or five piston displacements, and with almost unlimited variations in specifications

and accessory equipment—brackets here and there on the engine block for starters, oil filters, etc.; choice of downdraft or updraft carburetor of a number of different models; similar choices in electrical equipment; and any number of types of special accessories and parts. The parts producers who supplied these engine companies were forced to operate similarly on a job-shop basis; many of them also operated mass-production lines for the passenger car manufacturers, but these lines were not adaptable to the needs of the independent engine companies.

Wartime demands for engines of this job-shop types were heavy, far in excess of any peacetime sales. For some models, orders were large enough to necessitate mass-production techniques, which had rarely been applied to engines of the size and power required for war uses. In addition to the engine demand, requirements for spare parts mounted explosively. Civilians, denied new engines, needed increasing quantities of spare parts to keep the old

ones running. The military services needed large quantities of spares, along with the engines, to stock depots and to provide for keeping in service equipment which could not receive normal peacetime care. As the number of engines in military service grew, replacement spare parts were likewise needed in increasing numbers. And military requirements tended to be overestimated—because of the lack of experience tables for guidance, because military maintenance people had to be given hurried training in stock

HOW the Nation's production capacity of industrial engines was increased to meet the tremendous demand of World War II is concisely and clearly told in this article which presents the Internal Combustion Engines and Parts section of the report, "Production—War-time Achievements and the Reconversion Outlook," made in October to the War Production Board by its chairman, J. A. Krug. Forseeing a continued peacetime need on a large scale for this equipment he concludes that "it is altogether possible that this expanded capacity can be utilized at a high rate for a considerable length of time."

Shipments of Internal Combustion Engines

1940-1944

(Excludes aircraft propulsion engines and slow-speed Diesels used in big electric power plants and for ship propulsion)

Year	Liquid-Cooled			Air-Cooled (Gasoline)
	Gasoline	Diesel	Total	
1940	559,000	63,000	622,000	Est. 300,000
1941	778,000	80,000	858,000	Est. 325,000
1942	1,210,000	109,000	1,319,000	Est. 350,000
1943	1,301,000	122,000	1,423,000	709,000
1944	1,793,000	152,000	1,945,000	675,000

control, and because it was not possible in the early stages to consolidate depot stocks of a given part which would fit two or more engines, so that separate inventories were maintained for each engine model.

In the early stages of the war, there was considerable debate about standardization and simplification of industrial engine models. Under Order L-254, models of air-cooled engines were simplified and standardized, and plants which before the war had turned out only 300,000 engines a year for washing machines, power lawn mowers, and similar uses produced in 1943 some 700,000 engines, ranging from small fractional horsepower to as much as 30 to 35 hp. These

engines were used to heat pilots' suits at high altitudes, to provide electricity for military kitchens, antiaircraft searchlights, telephone and radio systems, and fire control of big guns, on sea and land; to power refrigerators for preservation of blood plasma and medical supplies and to light ships.

No such simplification and standardization program was applied to liquid-cooled engines. Some models and model variations were ordered discontinued, but an extensive program along this line would have required redesign of trucks, construction machinery, farm equipment, industrial equipment, etc., built around existing models. Those who argued that the resulting delays in deliveries of these end-items would more than offset the advantages of standardization prevailed, and after order books of the engine makers had been loaded up, the argument became academic.

The wartime production record on engines was a good one. With the help of WPB-sponsored plant ex-

power plants and for ship propulsion.

With the large production gains and the limitations on production of many types of engine-powered equipment, total engine production was approximately in balance with approved requirements. But throughout the war period, there were shortages in nearly all types of engines, and there was a constant demand for more and more engine parts.

In 1944, for example, production of liquid-cooled engines totalled 1,945,000, which was slightly in excess of WPB-programmed end product requirements of 1,890,000, though short of the stated total requirements of 2,239,000. But in the larger engines—over 350 hp—programmed requirements were not met. The numbers were small in relation to total production—for example, 124,000 gasoline engines of 350 to 850 hp were produced, compared with 181,000 screened requirements. But the uses were urgent, and as a result, a further expansion program was initiated for the larger engines, and for parts for such engines, to be ready in mid-1945. The drop in military requirements came before the full benefit of this expansion had been felt.

Engines were used during the war for lift trucks, pumps, compressors, and other industrial equipment; for cranes, shovels, and tractors; for farm equipment, mining equipment, trucks; for logging and sawmill machinery; for power generation at Army bases and on ships; for propulsion of landing craft, amphibious vehicles, and other combat vehicles; for smoke generators and filtration units and refrigeration plants; and for countless other uses, military and war-supporting. Because of the wide variety of uses, distribution of internal combustion engines—and spare parts—was a difficult and continuing problem.

These engines were put under control of General Scheduling Order M-293 from the beginning of that order, early in 1943, and a wide variety of parts were also included. Scheduling was never a complete success—a balanced flow of parts could not be assured, and consequently engine production never came up to the levels of manufacturers' schedules—but it did

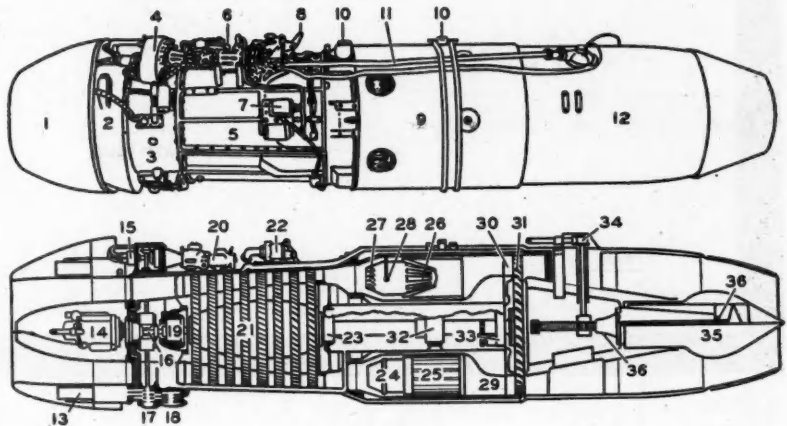
(Turn to page 114, please)

pansion and cooperative action from the Armed Services, production was built up in all engine types. The accompanying table on this page is illustrative; it excludes aircraft propulsion engines and slow-speed (under 750 rpm) Diesels used in big electric

Junkers Jumo Turbo-Jet Engine

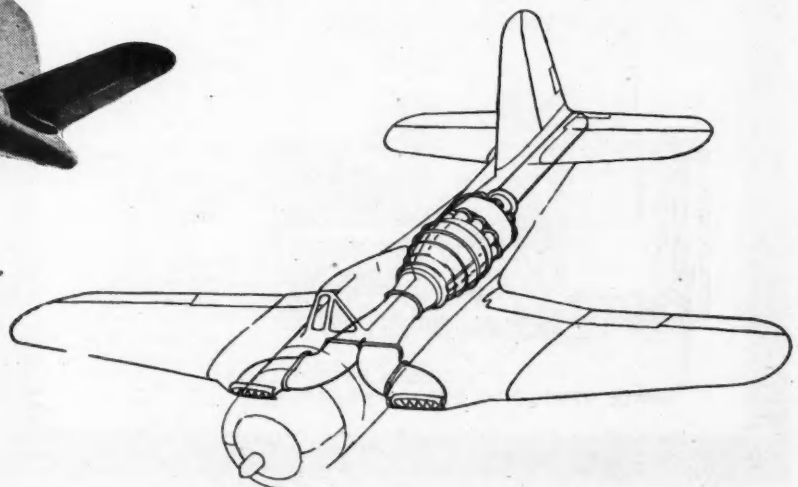
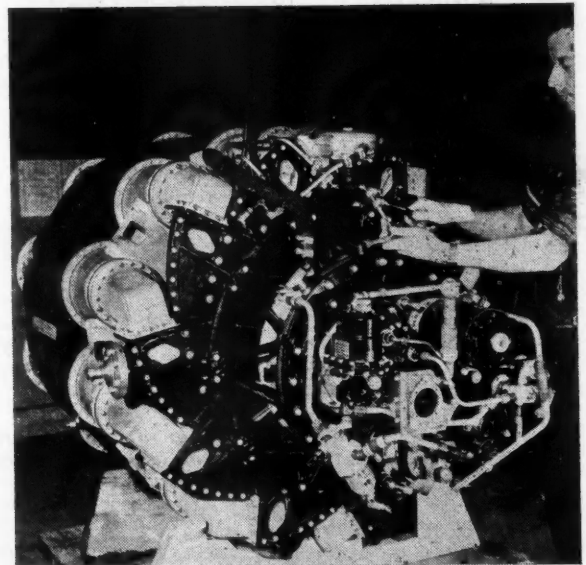
Port side and sectional drawing of the Junkers Jumo 004 B turbo-jet propulsion engine which was described on page 18 of the October 1 issue of Automotive and Aviation Industries. The following legend gives the names of the numbered parts:

- | | |
|---------------------------------|--|
| 1—Nose cowl | 20—Speed regulator |
| 2—Oil tank | 21—Compressor rotor |
| 3—Entry casing | 22—Fuel filter |
| 4—Auxiliary gear box | 23—Rear compressor bearing |
| 5—Compressor casing | 24—Flame tube |
| 6—Servo motor | 25—Combustion chamber muffle |
| 7—Ignition apparatus | 26—Diffusing grill |
| 8—Control lever | 27—Combustion chamber |
| 9—Outer casing | 28—Injection nozzle |
| 10—Attachment points | 29—Turbine entry ducting |
| 11—Movable bullet control shaft | 30—Turbine stator blades |
| 12—Exhaust casing | 31—Turbine wheel |
| 13—Annular fuel tank | 32—Forward turbine bearing |
| 14—Riedel starter | 33—Rear turbine bearing with oil scavenge pump |
| 15—Injection pump | 34—Movable bullet operating gears |
| 16—Auxiliary drive | 35—Movable bullet |
| 17—Oil pump | 36—Movable bullet support |
| 18—Oil filter | |
| 19—Front compressor bearing | |



Ryan Fireball

FIRST fighter plane of the Navy to use jet propulsion, the Fireball (FR-1) was beginning to roll off the Ryan Aeronautical Company's production line when the war ended the middle of August. A low wing, single seat monoplane with folding type wings and retractable tricycle landing gear, it is equipped with two powerplants—at the front a 1350 hp Wright Cyclone radial engine (R-1820) fitted with a Curtiss Electric fast feathering propeller, and at the rear the General Electric I-16 turbo-jet propulsion engine. With droppable tanks its maximum range cruising at 207 mph is 1500 miles. At full throttle, the front engine alone gives 320 mph and the jet engine will drive the Fireball at 300



mph. The Navy has not released its top speed with both engines, but to give an idea of its performance states that it can climb at nearly 5300 fpm and that the top speed curve varies very little up to 25,000 ft. On this page is shown the Fireball in flight, the installation (line drawing) of the I-16 turbo-jet system, a front view of the I-16 engine.

Transient

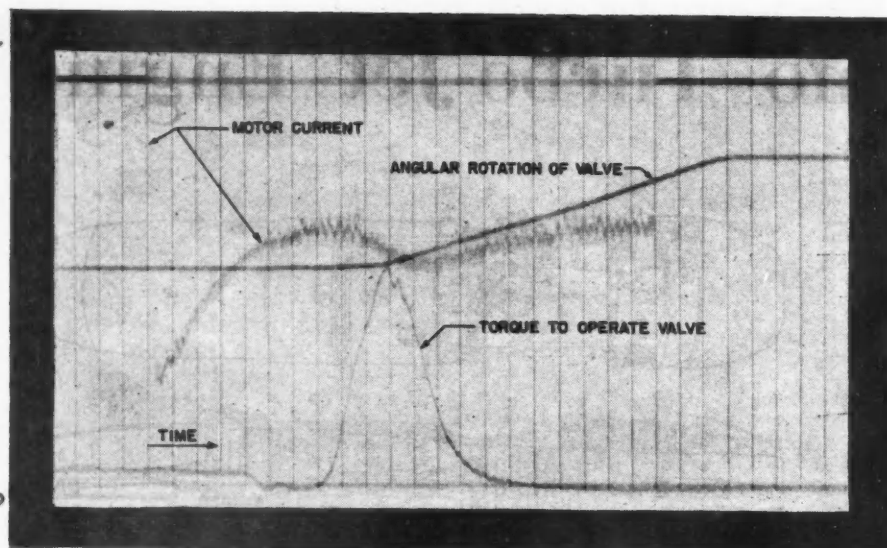


Fig. 1. Oscillogram showing electric motor actuation of hydraulic selector valve.

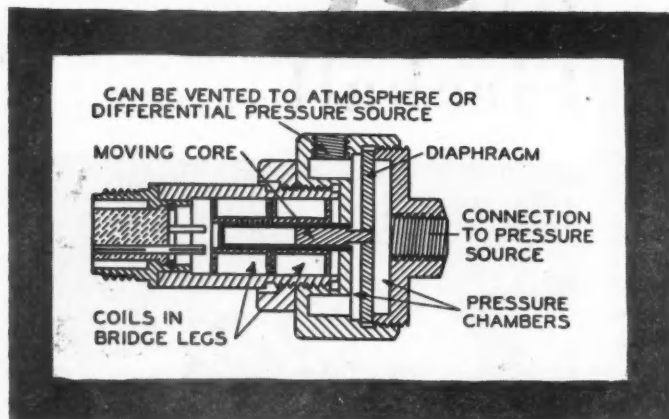
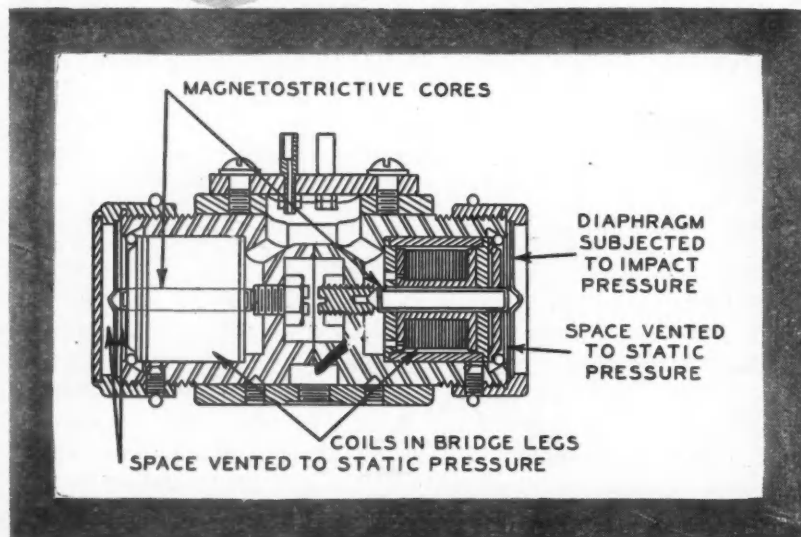


Fig. 2. Variable air gap inductive pressure gage (Courtesy Trimount Instrument Co.).

Fig. 3. Magnetostrictive gage to indicate pulsations in air streams (Courtesy General Electric Co.).



WITH the moving-mirror type oscillograph as a basic recording instrument, the record-it-fast and study-it-slow technique has reached a high state of excellence

in recent years. Simultaneous records of various functions may be made on a common time axis—traces which may be superimposed on one another for clarity, or which may cross and recross on the record film without interference because they are recorded by rays of light reflected from the galvanometer mirrors. This point is mentioned because it often happens that none of the traces is important in itself; it is their difference, phasing, or other relationship that tells the story. A representative transient record obtained from a hydraulic mechanism appears in Fig. 1 which shows electrical actuation of a hydraulic valve.

In hydraulic and pneumatic systems the most common transient requiring study is that of pressure. Various methods of indicating pressure transients will be presented. The first is inductive, using a variable air gap. The gage, Fig. 2, has a diaphragm, one side of which is exposed to the pressure under study. To the opposite side is attached a floating rod of magnetic material which acts as the core of a solenoid. Movement of this core changes the gap in the magnetic circuit, which in turn changes the inductive impedance of the solenoid. The diaphragm serves the dual purpose of changing pressure to force and acting as a spring to resist motion produced by this force.

This type of pickup or gage is usually installed as one leg of the bridge. To balance the bridge for zero output, a similar coil of equal impedance is used as a dummy leg and it is the usual practice to install this

Recording Pickup Methods

By Edward J. Partington
and Sydney E. Westman

Development Engineers,
Pacific Div.,
Bendix Aviation Corp.

in the gage housing so that it will be subjected to approximately the same temperature conditions as the active coil. The magnetic core is surrounded by a metal sleeve closed at one end and brazed to the case which holds the diaphragm. Pressure can be applied to both sides of the diaphragm, enabling it to be used as a differential pressure gage.

Inductance is varied by the magnetostrictive principle in the gage shown in Fig. 3. The diaphragm center bears against the end of a highly permeable magnetic core which is restrained at the other end by a fixed stop. The core wall is sufficiently thin to be saturated by the excitation magnetomotive force. A change in stress of the core produces a change in its magnetic permeability with a resultant change in flux and coil inductance. This gage was designed to record impact or velocity pressure pulsations in an air stream, such as propeller wash or carburetor air scoop pulsations.

In order that the core can be designed for both stress and flux saturation, the diaphragm is sometimes supported by a spring. Fig. 4 shows a gage that was used to indicate fluid pressures of 2000 psi without increasing the original volume of the line. The pressure acts against one end of a rod, the other end of which rests against the magnetostrictive core.

The recording of pressures without adding a volume which may change the dynamic pressure characteristics of the system, or which may act as a resonance damping chamber, presents a problem which can be solved by cementing resistance type strain grids directly to the tube, Fig. 5, after the wall thickness is reduced to give the desired hoop strain. (Bonded resistance wire strain gages are protected by patent. Prospective users should investi-

Fig. 4. Magnetostrictive pressure gage for 2000 psi (Courtesy General Electric Co.).

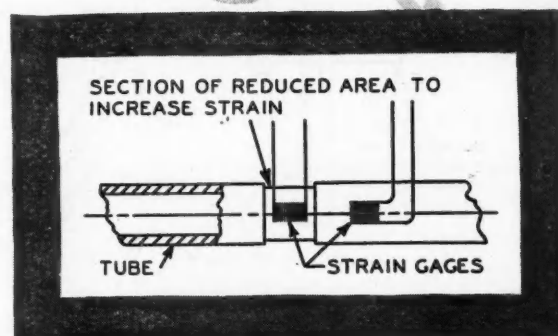
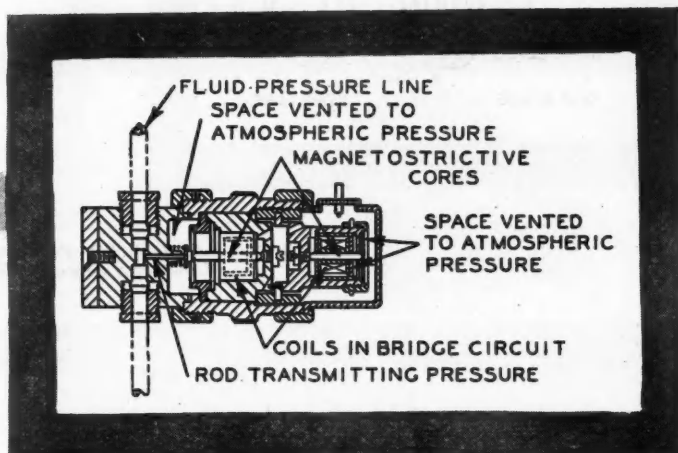
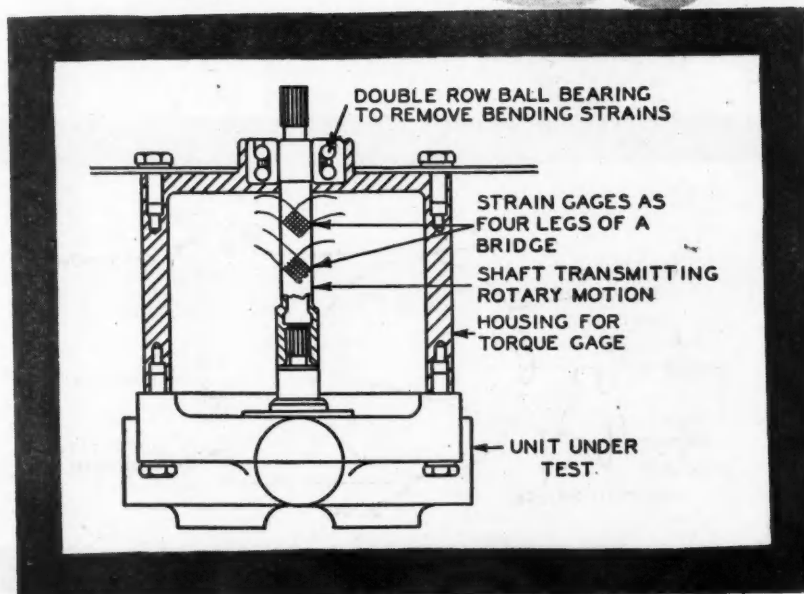


Fig. 5. Resistance strain grids as used to pick up pressure in tube (Courtesy The Baldwin Locomotive Works).

Fig. 6. Torsion indication by means of strain grids (Courtesy The Baldwin Locomotive Works).



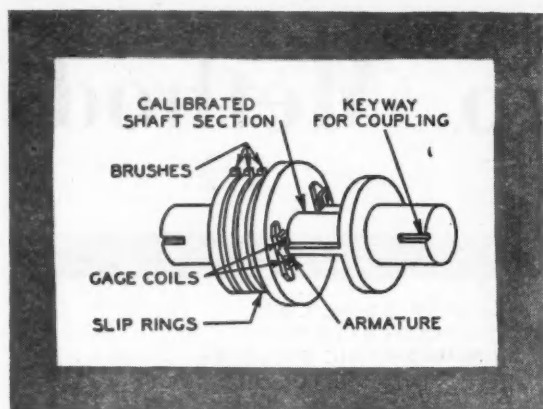


Fig. 7. Variable air gap inductive torque gage (Courtesy General Electric Co.).

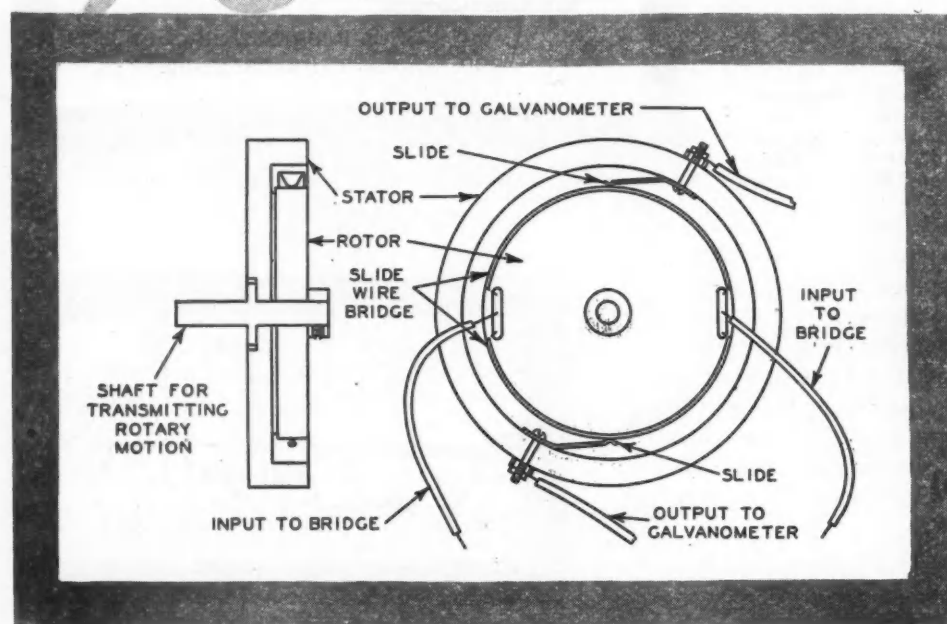
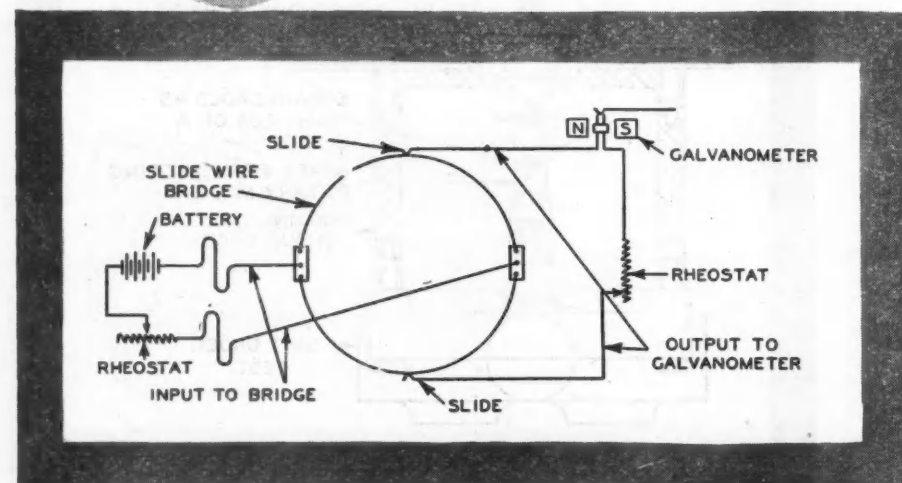


Fig. 8-A. Slide wire pickup for indicating angular motions.

Fig. 8-B. Bridge circuit for A.



gate the restrictions governing their application.) Where there is considerable temperature variation it is desirable to use grids having little resistance change with temperature, and to cement the balance or "dummy" grid on the tube near the active grid. Any resistance change due to strain in the balance grid tends to cancel, in terms of gage output, resistance change of the active grid. Pressure sensitivity of the balance grid is suppressed to a minimum by mounting it on an unreduced wall section, and orienting it along the axis instead of around the circumference. Use of four resistance grids, alternate ones active, the other two "dummy," increases the output of the gage.

Torsional loads in a shaft can be picked up by strain grids cemented to the shaft along its shear axis, Fig. 6. If the shaft does not turn more than one complete revolution, connection can be made through flexible leads soldered directly to the strain grids. One, two, or four active bridge legs can be used depending on the surface available for attaching them, and the output desired. It is the usual practice to provide slip rings on a revolving shaft, in which torsion is to be indicated.

A more elaborate torque gage, Fig. 7, is of the variable air gap inductance type. Four solenoids are rigidly attached in pairs on opposite sides of the shaft transmitting the torque. Some distance along the shaft a collar is rigidly attached and two times extending from this collar form the armature or pole piece of the solenoid pairs. Torsion in the shaft causes an angular displacement of the armature and the solenoid core. The solenoids are connected as a bridge such that diametrically opposed coils increase their inductance with torque, while inductance in the other two coils decreases. This gage to date is limited to

shafts revolving at speeds below 4000 rpm and a minimum torque rating of 100 ft lb.

Travel or position transients will next be considered. When a small amount of drag is not objectionable, viz, when the operating forces are high, a resistance bridge or potentiometer can be used without the need of amplification. Fig. 8 shows such a pickup, and its schematic wiring diagram. This equipment is designed to indicate angular position and is limited, without gearing, to rotation not exceeding 180 deg. Fig. 9 shows a pickup and the schematic wiring for using it to record linear travel.

Fig. 10 shows a gage used to indicate valve travel in a system operating at pressures not to exceed 2000 psi. The valve was designed to open not more than 0.005 in. and at frequencies up to 50 cps. Undesired frequencies or "valve chatter" were indicated up to the pass frequency of the amplifier equipment, which was better than 500 cps. Since the armature was approximately 0.125 in. diam by 0.625 in. long and had a wall thickness of only six mils, its mass was a small part of the valve mass. Good linearity up to 0.030 in. was shown, and how much farther this could be extended was not checked. The balance coil was similar but was not connected mechanically to the active gage, nor was it subjected to the fluid pressure, since it was not desirable to increase the physical size of the gage.

The practical utility of transient recording in development work is best illustrated by a case history. That of a power brake valve will be used.

A power brake valve admits a controlled amount of fluid to a brake from a hydraulic system maintained at high pressure. The valve is pedal operated and is expected to have a pedal reaction ("feel") approximating that of the family automobile brakes. A power braking system is used where the work required for a full brake application is more than can be expected from the pilot's foot—commonly on airplanes upward of 15,000 lb in gross weight.

Fig. 11 is sufficiently typical of brake valves to illustrate their operation. Depressing the pedal moves the piston, unseating the inlet poppet. Fluid pours through the reaction chamber and brake line to the brake, raising its pressure. Rising pressure compresses the spring, returning the piston and closing the inlet poppet. Then we have a condition of static equilibrium until the pilot changes the load on the pedal. In all cases, however, he "feels" the pressure in the reaction chamber. After the pilot depresses his pedal, there may be a time lag while the brake comes up to pressure—a dangerous feature when the plane is rolling at high speed.

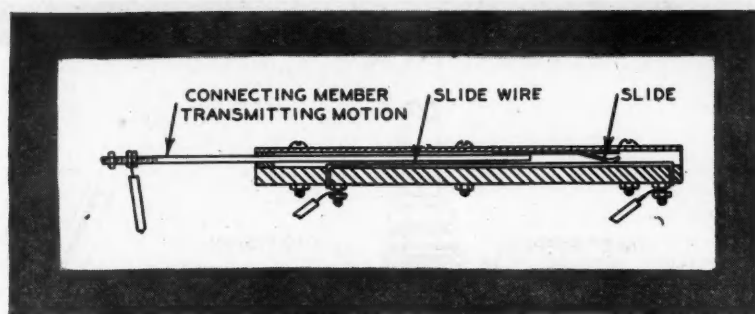


Fig. 9-A. Slide wire linear motion pickup.

Fig. 9-B. Bridge circuit for A.

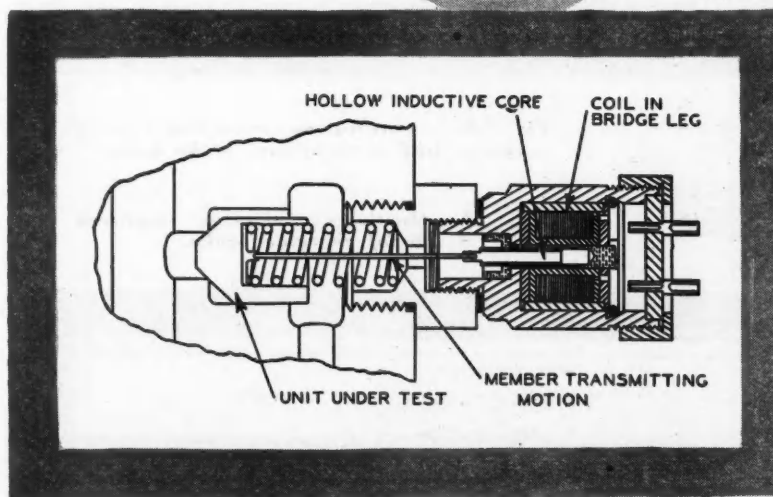
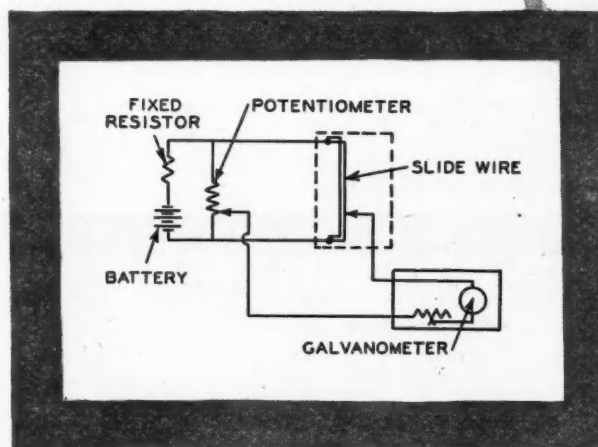


Fig. 10. Linear motion gage using variable air gap inductive principle (Courtesy General Electric Co.).

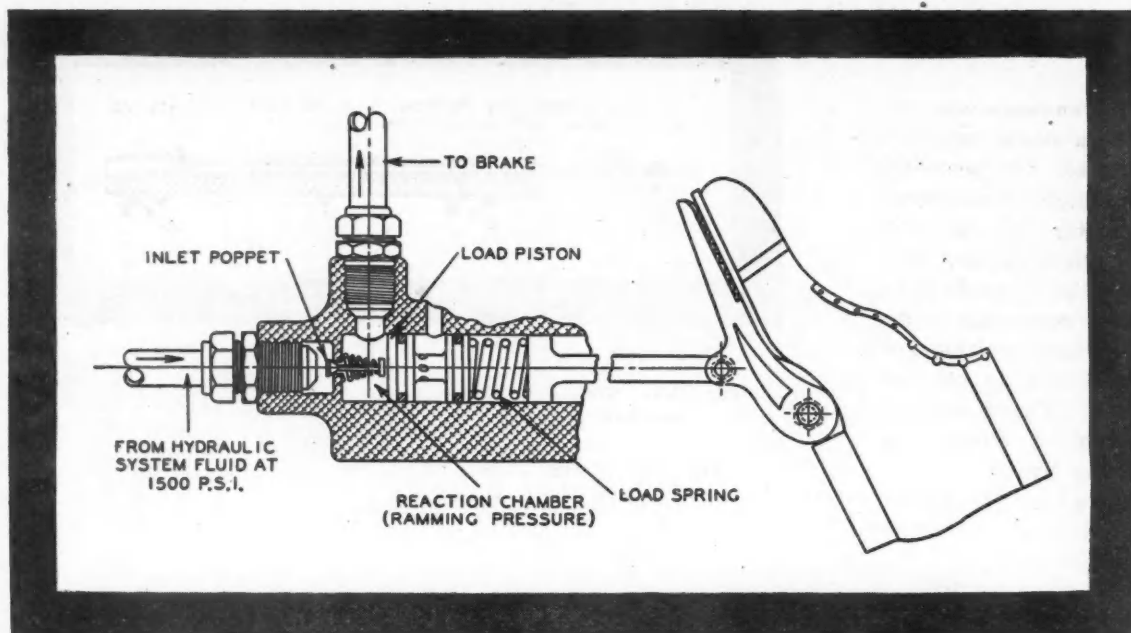


Fig. 11. Schematic diagram of power brake valve.

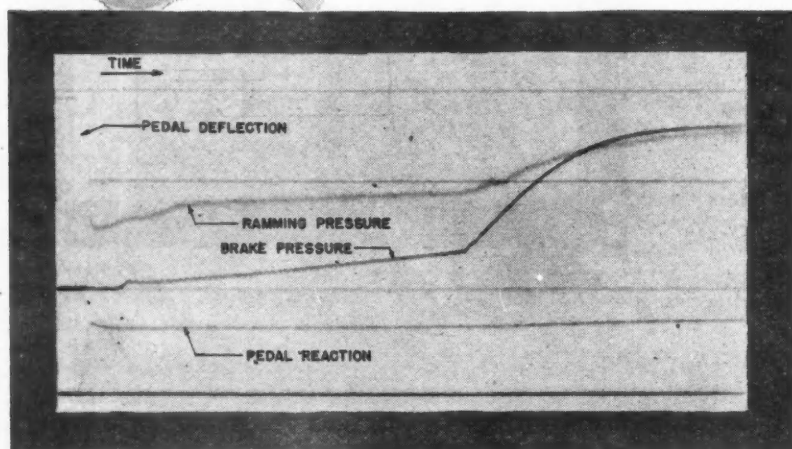
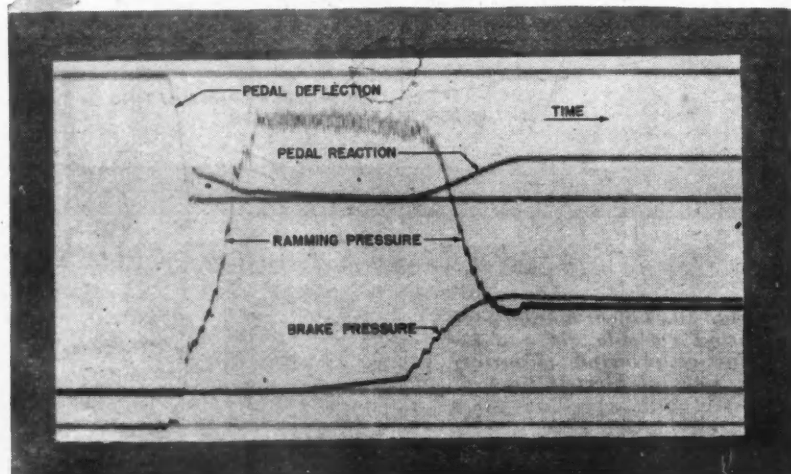


Fig. 12. Oscillogram recording brake charge with conventional brake valve.

Fig. 13. Oscillogram showing improved rate of charging brake.



The most obvious (and as it turned out, least effective) method of increasing the flow from the brake valve was to increase the diameter of the inlet poppet. It was realized that this measure could be effective only if it increased pressure in the reaction chamber during the fill. This we sometimes term the "ramming" pressure since it is the difference between reaction chamber pressure and brake pressure which causes fluid to flow. At the start of the fill, this ramming pressure was an unknown fraction of final pressure, rising to final pressure as flow decreased.

The point to be settled was the value of this fraction during most of the fill. If, on a 100 psi brake application, the ram pressure started at 10 psi, quadrupling it would be well worth while.

The oscillogram in Fig. 12 is one of a group which recorded the following functions during typical brake applications: (1) Pedal deflection; (2) Ramming pressure; (3) Pressure in brake; (4) Pedal reaction ("feel"). These functions were recorded on a time basis, vertical timing lines being thrown on the film 60 per sec by an appropriate mechanism which is a feature of the oscillograph. The oscillogram shows an application to 150 psi using an extremely large volume dummy brake, connected to the brake valve through a long tube including several bends and fittings—a brake line of quite high impedance.

(Turn to page 64, please)

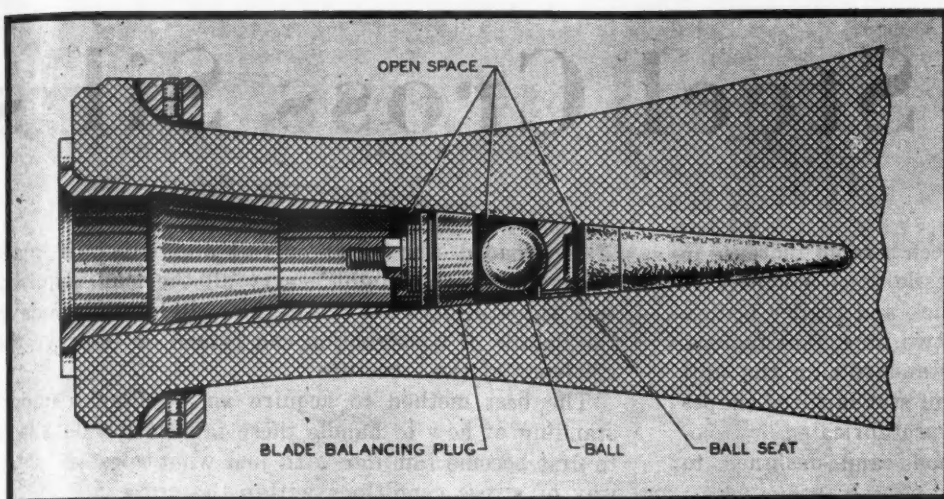


Fig. 1 — Sectional view showing installation of ball vibration damper in shank of propeller blade.

Steel Ball Controls Propeller Blade Vibration

INCREASED performance for several fighter and bomber type aircraft was made possible by a device which controls propeller blade vibrations set up by engine firing during flight and reduces vibration stresses to less than half of their former intensity. Consisting of a solid steel ball weighing less than eight oz and a socket seat, as shown in Fig. 1, it was developed at the Hamilton Standard Propellers Division of United Aircraft Corp. and was used to make certain efficient type propeller blades suitable for engines of greater horsepower. The investigation is to be continued to effect a reduction in propeller weight.

The steel ball, which is smaller in diameter than its socket and moves back and forth at increasing speed as the engine speed increases, is "tuned" with the vibrations of the particular installation. Its motion sets up forces that counteract the blade vibration by exerting pressure directly through the ball seat to the sides of the blade (see Fig. 2). In operation the ball moves less than $\frac{1}{8}$ in. at speeds up to 230 times per second between the seat and plug, which retains the ball in the blade.

Aircraft equipped with this vibration damper include two Navy fighters, the Grumman F6F Hellcat and Chance Vought F4U Corsair, and the Consolidated PB4Y-2 Privateer patrol-bomber.

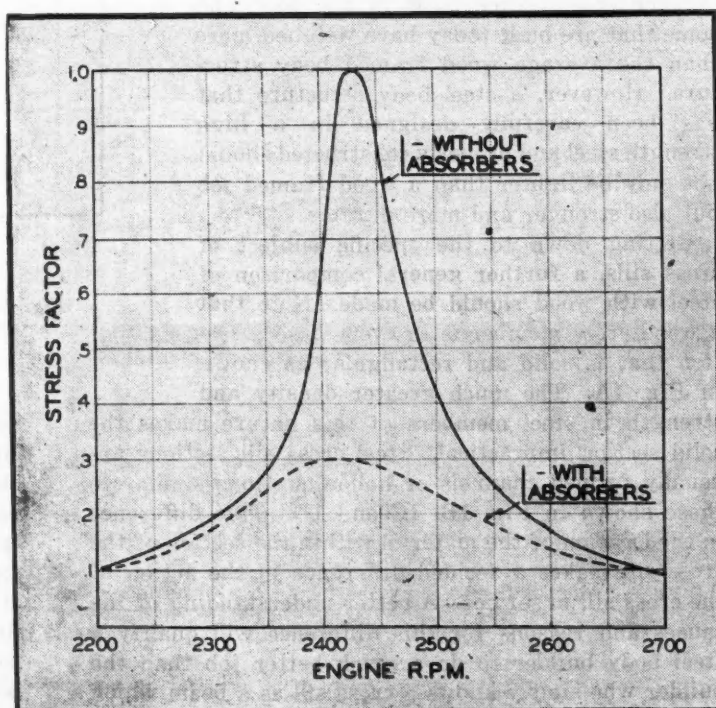


Fig. 2.—Change of stress factor in propeller blade with engine speed.

Steel Cross Sills a

FOR several years there has been a rapid increase in usage of standard high tensile steel members in the framing for modern truck and trailer bodies. This is being brought about by two important factors. The first is the advantage of standardizing the unit construction details through use of standardized shapes and sections which have been prefabricated by economical mass production methods and designed to simplify the body shop assembly.

The second is that designs in steel may be held to more exact limits because the physical properties in manufactured steel can be and are held to very close and uniform tolerances. For this reason the safety factor margin of a design in steel can be held much lower than that necessary in wood. Tests on runs of steels of the same make and grade show there is rarely a difference in physical properties of more than five per cent, yet lumber cut from the same log may vary as much as 200 per cent and in occasional cases even higher in its ability to act as a beam or strut supporting a load. This is due to variations in the direction of the grain, differences in the density of the fibers at different points within the log, and knots which distort the entire fiber structure in the immediate area of the knot. The difficulty of obtaining properly seasoned lumber of dependable physical properties on today's market has greatly aggravated this condition.

Some steel bodies built in the past and some that are built today have weighed more than the average wood framed body structure. However, a steel body structure that has been carefully designed in a high strength steel and properly constructed should not only be lighter than a wood framed job but also stronger and more durable.

Getting down to the specific subject of cross sills, a further general comparison of steel with wood should be made. Note that a wood cross member is in every case a section that is solid and rectangular as shown in Fig. 1A. The much greater density and strength in steel members of this nature makes the solid section impractical. Steel cross sill sections are usually formed channels or hollow sections similar to those shown in Fig. 1B, 1C and 1D. This difference in the location of the material within the section of the cross sill makes a decided difference in the action of the cross sill in service. A better understanding of the causes and reasons for this difference will qualify a steel body builder to do a much better job than the builder who simply knows a cross sill as a beam which

if overloaded may bend or fail and which if made "heavy" enough "might" carry all the load required, but who still does not realize how slight variations in the details of construction can retard or improve the efficiency of the structure.

The best method to acquire an intelligent understanding of how to handle these fabrication details is to first become familiar with just what goes on in the way of stress conditions within the cross sill and an understanding of the nature of the reacting forces adjacent to it when the cross sill is put to work under operating loads. Fig. 2 shows a case of a very heavy cross sill loading. Of course, the amount and position of these load forces in a truck or trailer body are indeterminate factors and can only be known as ap-

proximates. Fig. 2 and the other illustrations to follow are not intended as a study of the amount of load forces. Their purpose is to show the "effect" of these or similar loading forces when they are applied to the cross sill in greater or lesser amounts but in approximately the same general positions.

In the particular case shown in Fig. 2 we assume there is a uniform floor load which exerts a force of 25 lb on every inch of width of the cross sill. This load can be generally transferred into three component re-

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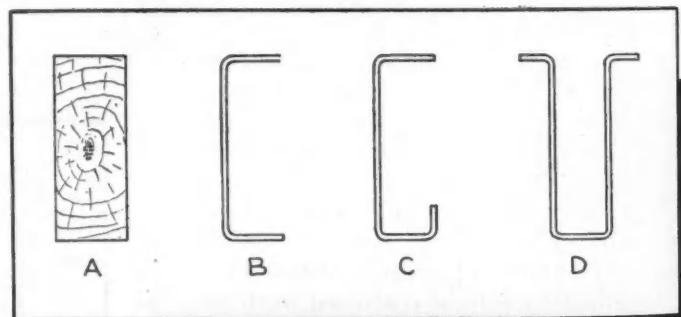


Fig. 1—Commonly used sections for truck body cross sills.

sultants of force. Two resultant loads of "S" at the sides would be 750 lb each and at a distance of 15 in. out from either side of the sill bearing or reaction points. One resultant load "C" would be 850 lb in the middle. In addition to the resultant loads "S" and "C" we have two more forces "W" of 200 lb each working at each end of the cross sill caused by the weight of the body side wall. The total of all these loads is $200 + 750 + 850 + 750 + 200 = 2750$ lb. This weight is equally supported over two points 34 in. apart which

S and Mountings

for Modern Steel Body Structures

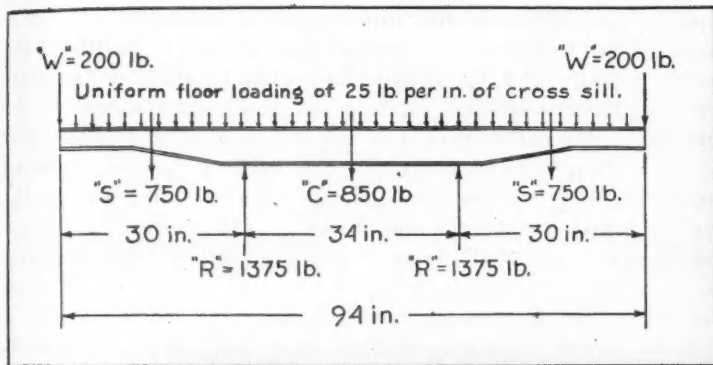


Fig. 2—Forces and reactions for a uniformly loaded cross sill.

W=Side wall and roof loads
C=Resultant of floor load in 34 in. of "center" at 25 psi of sill
R=Reactionary loads.
S=Resultant of floor load on 30 in. of "side" at 25 psi of sill

represents the width of chassis frame. (Fig. 2 above).

Since the top loads are equally distributed in equal amounts, each reaction point will take one-half of the total of the 2750 lb of force exerted or 1375 lb. Therefore, there are two reaction forces "R" of 1375 lb each working on the bottom flange of the cross sill. Notice that this is the greatest amount of load concentrated at any one location through the entire cross sill. Also notice the position of these forces "R" of 1375 lb each and the upward direction in which they are applied. This point at which the reactionary force "R" acts against the bottom flange is the most critically stressed zone on the entire cross sill. Note carefully that the loads considered to now are static loads in a body which is not moving. When the unit starts rolling over the highway, vibrations and impacts are set up which will actually double the effect of these static loads on the frame members. It is, therefore, considered good engineering practice to add at least 100 per cent and sometimes as much as 150 per cent to these static loads to compensate for the impact force they will impart to the structure when they become dynamic moving loads subject to the many various road shock conditions.

Fig. 3 shows one end of the cross sill in detail. From the zone directly above the reactionary force "R" we have re-

moved a section of the channel. Now to replace the top flange section removed we have welded a wire at AB across the gap. To replace the bottom flange we have inserted a ball at CD within the gap. Studying the direction of the forces "S" and "W" it is easy to see that the wire will go into tension and the ball be compressed. In combination the two will hold the member intact across the gap. If the positions of the wire and the ball were reversed with wire at the bottom and ball at top, the assembly would then collapse because the ball between points A and B would drop out as the forces S and W tended to move the points A and B apart while the wire between C and D would tend to buckle up. This experiment clearly illustrates an important condition which exists immediately above the reactionary force "R" in any cross sill. In

this zone the top flange section of the channel tends to pull apart, or is in maximum tension. At the same time the bottom flange section of the channel tends to push together or is under maximum compression at the point where the reaction force "R" meets it.

Under Fig. 3 two groups of calculations are made.

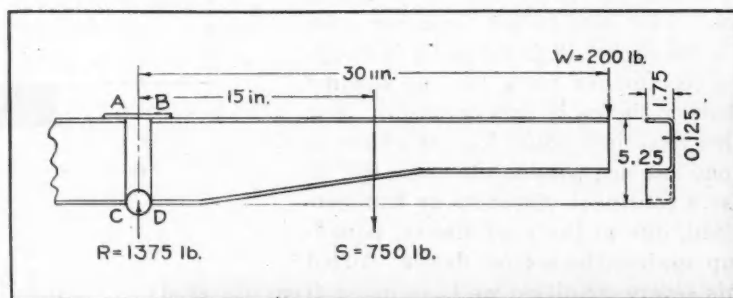


Fig. 3—Resolution of forces about one of the overhanging ends of a cross sill.

Calculations for Pull on Wire AB and Pressure on Ball CD:

	in. lb.
Force "S" causes 15×750	$= 11,250$
Force "W" causes 30×200	$= 6,000$
Total in. lb. caused by static load forces	$= 17,250$
Add 100 per cent for road shock or impact safety factor	$= 17,250$
Total in. lb. at "R"	$= 34,500$
Total tension on wire and	

total compression on ball =
34,500
 $\div 5.25 = 6,571$ lb.

Calculations for Capacity of the Flanges to Carry Tension or Compression Before Reaching the Yield Point of High Tensile Steel at 50,000 psi:

Cross sectional area of metal in each flange $= 0.125 \times 1.75 = .218$ sq in.
Capacity of each flange $= 0.218 \times 50,000 = 10,900$ lb.

One shows the actual amount of tension and pressure exerted on the wire and ball due to the loads shown. The other calculation shows the actual capacity of the top and bottom flanges to resist this pressure in direct tension or compression. Compared with the exact methods of computing moments of inertia and section moduli, this method of calculation is extremely simplified and can give only an approximate result. The web section has been neglected, but to help compensate this condition the moment arm distance of the flange sectional area has been taken at the extreme fiber distance and the radius at the corner disregarded. This approximate method is well on the safe side of the design and is done intentionally to help the reader to better visualize and understand only the important stress conditions without becoming lost in a maze of intricate engineering computations.

These calculations show that there is 6571 lb compression on the ball and 6571 lb tension in the wire. The calculations of flange capacity show that these flanges have a capacity for resisting tensile or compressive forces equal to 10,900 lb before the yield point is reached. Under these circumstances with only 6571 lb of working force and 10,900 lb of resisting capacity, one is lead to believe that all is well and that this design is plenty safe to carry the loads involved. But at this point another complication is present. This cross sill with the loads as they are shown is a very dangerous set up. Even though the flange metal has the capacity of resisting the tension and compression forces, the combination of all the forces as studied in Fig. 3 will work together to cause a buckling at the bottom compression carrying flange to the extent that the sill tends to fold up and sag as shown in Fig 4. This condition is caused by the combination of the compression force in the bottom flange and the reacting force "R" pushing up against it.

Fig. 4 shows just how the bottom flange under heavy compression at the point of application of load "R" starts to buckle. The longitudinal member over which the cross sill is mounted is exerting a reactionary force "R" up against the bottom flange of this cross sill. It is the heaviest individual load working at any one location outside the cross sill. It is also a continual vibrating or hammering load, due to the road shocks, pounding up against the bottom flange. Added to this severe condition we have noted from our study at Fig. 3 that this bottom flange is already under heavy compression forces at this point which tend to assist this buckling action. Until it was appreciated just what caused failures of this nature, the tendency of the body builder has been to increase the weight and size of the cross sill or use more cross sills to overcome this difficulty. Yet our calculations have already shown that the cross sill is satisfactory for size and section, except for its weakness in buckling resistance. The proper approach to this design is not a heavier or more frequently spaced cross sill which throws a considerable surplus of weight into the body where it is not needed. The best answer is to take care of the

cause of the trouble, that is, reinforce against buckling. This may be done in several ways.

Fig. 5 shows four different devices which are all satisfactory as a means of resisting the bottom flange buckling tendencies. In Fig. 5A this is done by simply welding a wide heavy flat plate to the bottom flange which extends a considerable distance in all ways from the point of bearing thus stiffening the flange and spreading the application of the reactionary load over a wider area. This design has objections in that it requires a heavy plate and forms a large mud pick-up pocket under the frame. Another objection is that in low mounted jobs it increases the loading height of the body floor by an amount equal to that of the plate thickness. Also it does not reach up the web of the cross sill to give any resistance to a twisting of torsional action on the sill. This torsional action is caused chiefly by the floor and floor load tending to pull the tops of the cross sills forward as the vehicle brakes are applied. It is rarely if ever serious, but when properly resisted, considerable vibration and twisting action on other body members is reduced.

Fig. 5B shows a better way than 5A of accomplishing this object. This consists of welding in a plate section which spans across the space between the toes of the top and bottom flanges, thus making it necessary to distort both flanges before any buckling at the bottom takes place. In conjunction with this it is well to use a light eighth in. angle or channel running along the top of the wood longitudinal sill. This insures a better bearing spread of the cross sill on the longitudinal sill. If the toe edge of the bottom cross sill

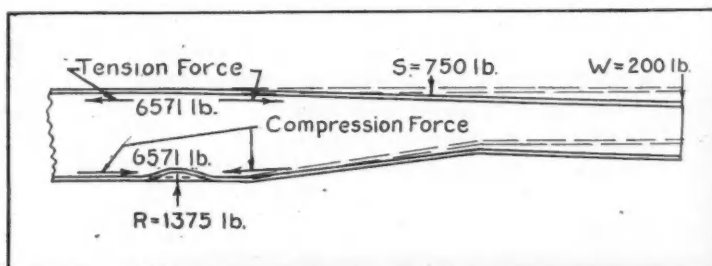


Fig. 4—Reaction force tends to start an upward buckle of bottom flange.

flange is welded to this bearing member, further resistance to buckling turn up is obtained.

A decided improvement over either of the methods shown in Fig. 5A or 5B is shown in Fig. 5C. Here the principle is the same relative to the buckling reinforcement as in 5B but the use of a light upright standing channel segment in place of the plate reinforcement has the effect of completely boxing in the zone on which the reaction force works. Here the impact and buckling forces from the bottom flange are not only resisted by an attachment to the top but also by a secure attachment to the web section of the cross sill.

Fig. 5D shows a set up that is superior to any of the previous methods. The principle of its function is also

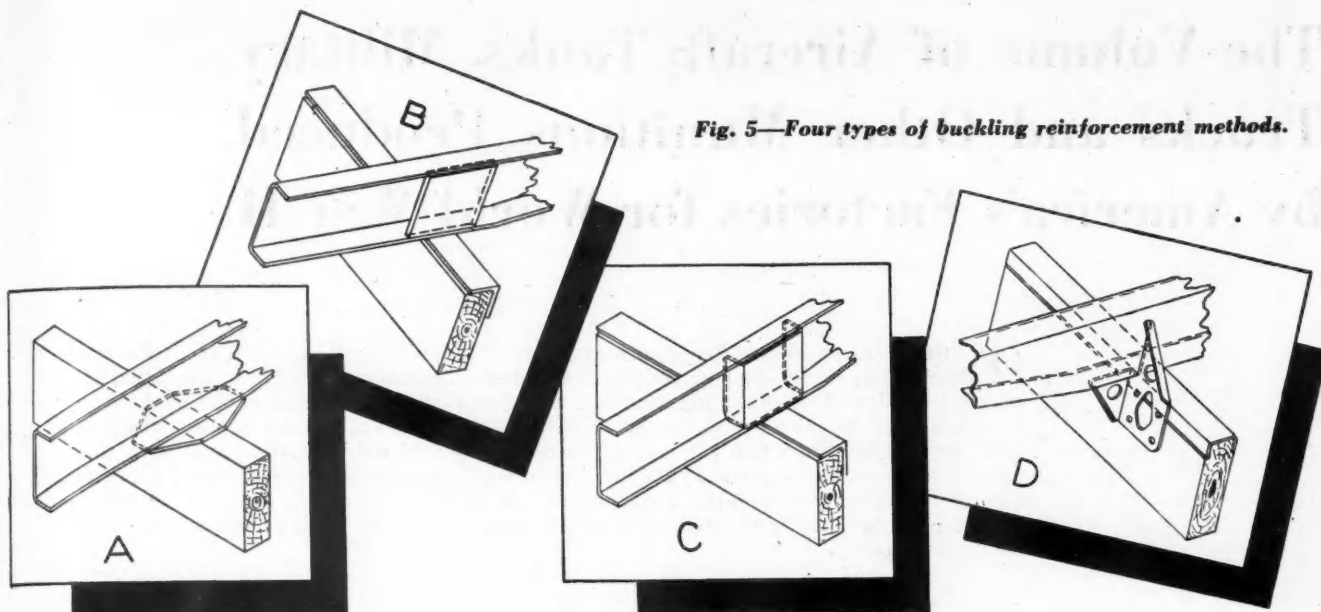


Fig. 5—Four types of buckling reinforcement methods.

quite different. It is a two way combination gusset which works in conjunction with a bearing channel capping the wood longitudinal sill. The lower or triangular buckling reinforcing portion of this gusset actually gets underneath the bottom flange. When this portion of the gusset is welded to the bottom flange of the cross sill the result is a tee section which prevents any buckling. This gusset has the additional advantage of spreading the effect of the reactionary forces out along the sill for several inches towards the end or the direction from which the acting load forces originate. The high back portion of this gusset reaches up on the web of the cross sill and becomes an effective torsional brace. The welded assembly of the cross sill, the bearing channel and this combination gusset gives a boxed in corner effect which is stiffest at the point of greatest reaction stress and which gradually becomes more flexible and yielding as the reactionary forces are dissipated further out in a wider spread area. In other words the detail of Fig. 5D is less rigid and has more cushioning or shock absorbing ability than the detail of Fig. 5C. The combination gusset design also has the added feature of affording a means of tying the structure down to the wood longitudinal sill. The combination gussets and bearing channels shown were developed by engineers of the Parish Pressed Steel Co.

Two other methods of resisting buckling action in a steel channel are shown in the Fig. 1C and 1D. In Fig. 1C the bottom flange is given an extra bent-up rib which is very good and does a fair job although it is not nearly equal to the efficiency of the direct zone applications shown in Fig. 5. Fig. 1D shows a very excellent set up from the standpoint of resisting buckling and torsion. The objection here, however, is that a double web is required in the section of the sill and the section represented by this web does not work efficiently in beam action. In fact this is the zone from which lightening holes are sometimes cut from the section, because this portion of the beam has more dead weight than it is worth in load carrying ability. The

lightest design and simplest, therefore, is the channel section of Fig. 1B but with the proper buckling reinforcement means added at the right places.

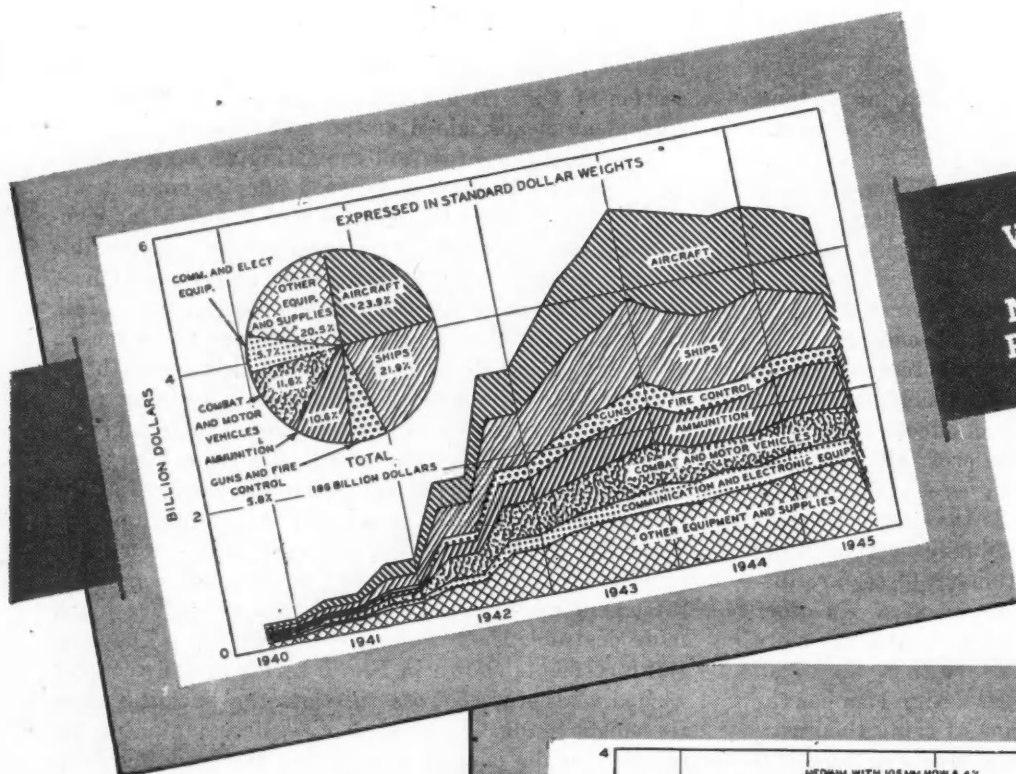
A combination cross sill consisting of a steel channel filled completely with a wood filler is not a desirable set up because the elasticity of the wood as compared to the elasticity of the steel makes it impossible for the wood to work at more than about one-fifth of its capacity at the point where the steel starts to fail. It is true that this wood liner increases the strength of the cross sill, but the reason for this strength increase is that the wood filler acts as a buckling reinforcement rather than giving an appreciable increase in bending strength. Therefore, if a wood filler is to be used, it is only necessary to use the wood fill at the vicinity of each bearing point over the longitudinal sill. Wood filling at other points does no useful work and consists of dead weight. Any of the buckling reinforcement methods shown in Fig. 5 series are much more desirable than the use of a wood filler. The steel reinforcements shown in Fig. 5 series are all securely welded to the steel cross sills and the buckling reinforcement action is obtained by a direct union of the metals. In the case of wood fillers the buckling reinforcement action is only obtained by a contact between the wood and steel.

An important detail which should not be overlooked in the proper mounting of steel cross sills is the longitudinal wood bearing sill and its steel capping angle or channel. Some body builders and equipment operators favor a steel longitudinal mounting channel for this purpose but when this is done the valuable cushioning effect of a wood base is lost. Although a wood longitudinal sill lacks a lot in the way of completely cushioning the effect of road shocks it is still a much superior material to steel for this particular purpose. Therefore, it is desirable to retain this property unless other flexible mounting devices are used. Use of this wood longitudinal sill presents two serious problems.

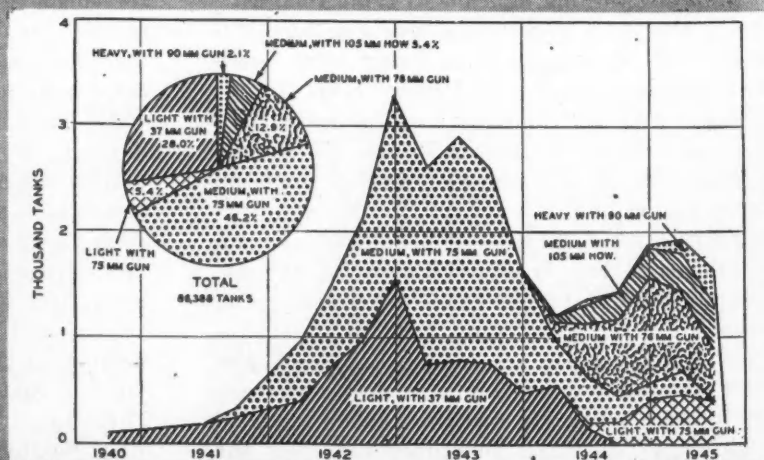
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The Volume of Aircraft, Tanks, Military Trucks and Other Munitions Produced by America's Factories for World War II

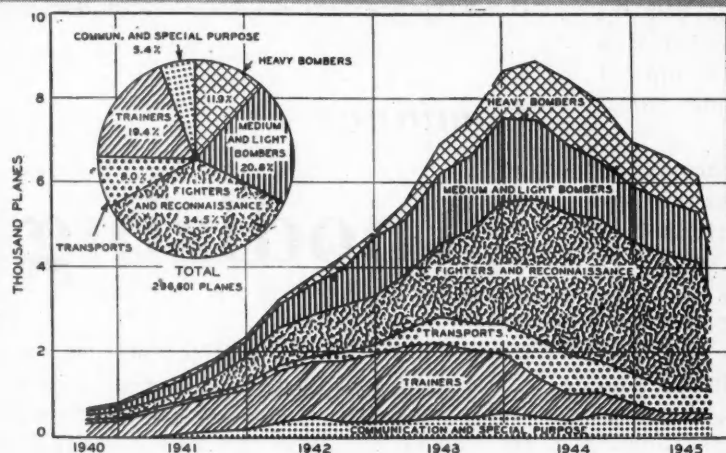
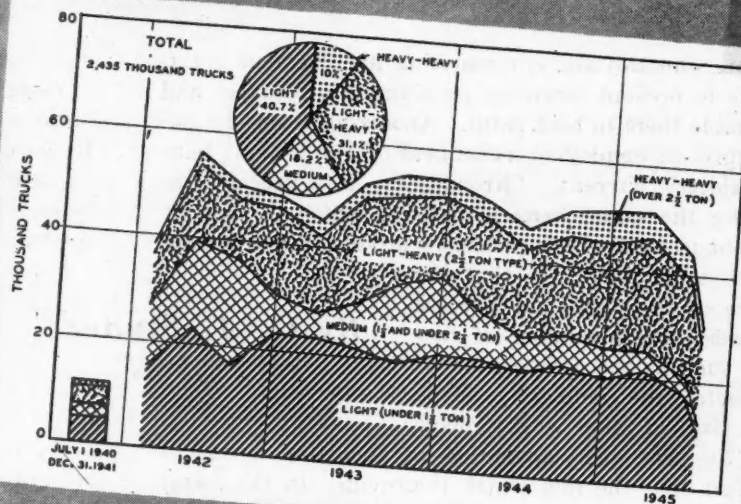
ON THESE two pages are five significant charts, based on data of the War Production Board, that reveal the tremendous total output of war goods by American industrial plants from July 1, 1940 to July 31, 1945. When war production reached the high mark, it represented 40 per cent of the total national output. The United States, which in 1939 devoted less than two per cent of its total output to military and naval uses, and about 70 per cent to immediate civilian needs with the remaining 28 per cent going to capital formation and civilian government expenditures, increased the war outlay to 40 per cent by 1944 with civilian production amounting to 50 per cent of the total national output.



Number of U. S. Army Tanks Produced

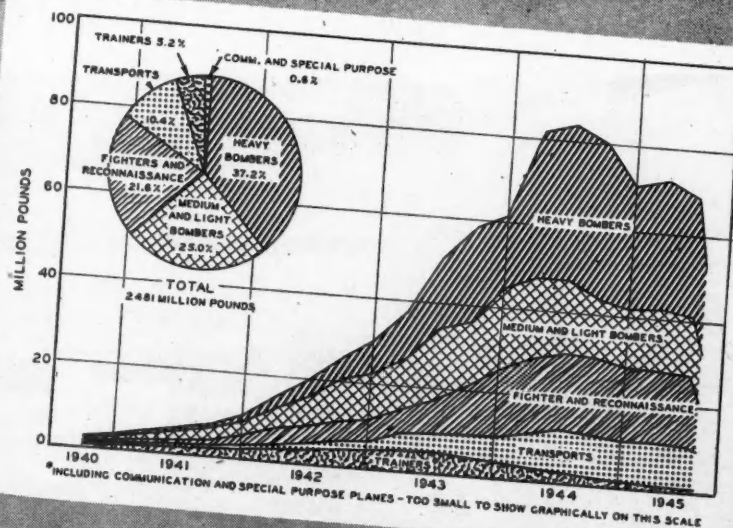


U. S. Military Trucks Produced



U. S. Military Airplanes Produced

Airframe Weight of U. S. Military Airplanes Produced



ANODIZING and chromatizing are chemical treatments to prevent corrosion on aluminum surfaces and to enable them to hold paint. Anodizing is an electrolytic process employing a chemical (chromic acid) bath and electric current. Chromatizing is a process employing the same chemical bath in which no electric current is used. Both processes produce approximately the same results so that the choice of the particular process depends upon a number of factors, such as the composition of the metal; the complexity, shape and size of the work; plant facilities, etc. The advantage of anodizing is due to the fact that the film which it provides on the metal surface is more resistant to abrasion and is heavier than that obtained by chromatizing. It is usually chosen for those parts of the aircraft that will be subjected to severe salt air conditions. Anodizing is the slower of the two processes and may become the "bottle-neck" of the production system, so that it is extremely necessary to carefully plan the equipment for the work, because satisfactory anodizing cannot be had at high speed.

An analysis of the necessary steps in the process of anodizing and chromatizing discloses that they are identical, except for the electrical current used in anodizing. These steps are: Cleaning the surface by immersion in a bath at a temperature of 180 F; a rinse bath at a temperature of 160 F; then either anodizing at a temperature of 96 F or chromatizing at a temperature of 120 F; followed by a rinse bath at a temperature of 160 F and then a dry air bath at a temperature of 180 F-200 F. A pre-cleaning operation is sometimes used when the metal is badly soiled. At Hughes this operation is not provided. An analysis indicated that a six-tank arrangement would satisfactorily do the job if the handling facilities were properly arranged. Since this becomes a joint anodizing-chromatizing layout it seems logical to provide

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Hughes Aircraft Co.

load frames that can be used for either process.

Work holders and work baskets are provided with hooks which permit them to be hung on the load frame. Because the frame is lowered and hoisted by the crane by means of only two hooks it is necessary that caution be used to uniformly load the work holders and baskets so that the load will be equally balanced on the frame.

All baskets have fixed casters equipped with Oilite bearings and stainless steel shaft so that they will always roll easily and not become rusted when immersed in the liquid. Bearings cannot be oiled because the oil may float in the liquid and deposit itself on a part being processed and thus spoil the part and cause its rejection. All work holders for the anodizing process must be made of aluminum or dural, because if the part, during the anodizing process, comes in contact with steel it will burn the point of contact. These same work holders can be used for chromatizing. Other types of work holders are also used, but all have

Combined

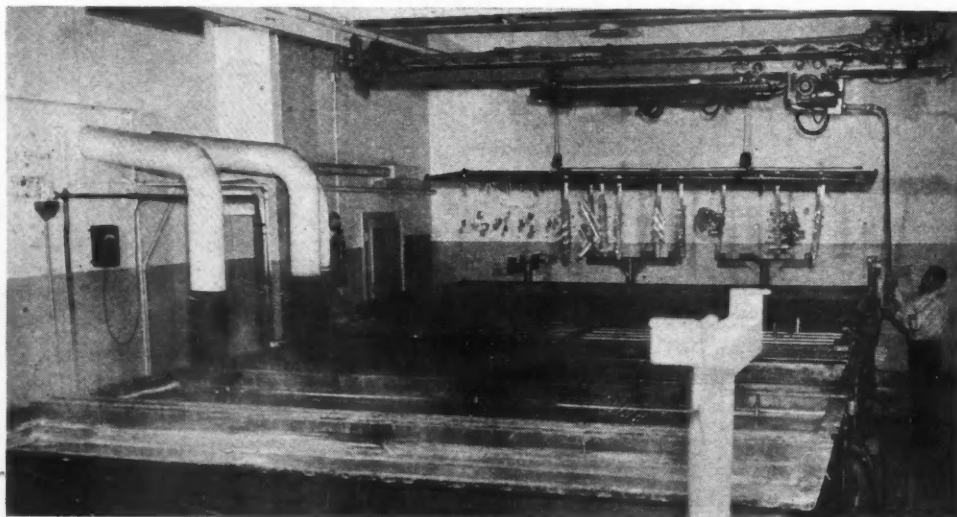
Anodizing —

the same principle of positive electrical contact.

After the load frame has been fully loaded, the operator moves the crane over it and prepares to pick the load up and move the work through the process. The crane provides for directional motion, i.e., forward and backward and side to side. This is accomplished by using the familiar double runway rails with a short bridge between, on which is suspended the hoisting mechanism. All motion is motor driven and controlled by a push-button pendant which hangs down

within the operator's reach at the "passage" end of the crane. So that the operator may engage or disengage the hoisting hooks from his operating station at the pendant, these hooks are connected by a rod which extends toward the operator. When he has lowered the hooks

Combined anodizing-chromatizing department with six-tank arrangement. In the background is the four-directional crane and a load frame with parts.





Batch of parts ready to be lowered into tank. This load frame can be used for either the anodizing or chromatizing process.

Chromatizing

Layout at the Hughes Plant

to a position where they may engage the eyelet in the load frame, from his position at the pendant and by means of the rod, he completes the engagement and proceeds to lift the loaded frame from its stand and move it to the alkaline cleaning tank where it is immersed in a cleaning solution and allowed to remain for two to five min.

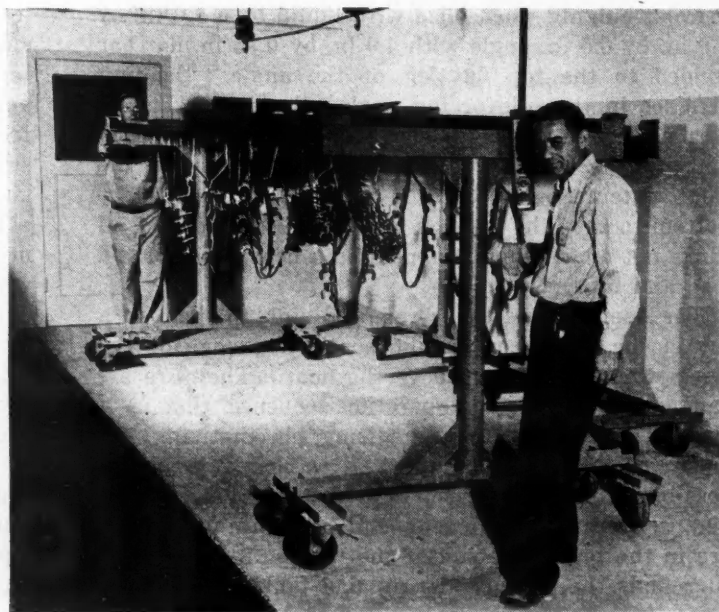
At the end of the cleaning time the operator raises the load, suspends it over the tank until the liquid has dripped off the parts, when he moves it to the rinse tank. Here he merely rinses the parts by raising and lowering the load a few times. Before removing the load he turns on a "skimmer jet" which removes all scum or foreign matter from the surface of the liquid.

From the rinse tank the operator moves the load to either the anodizing or chromatizing tank, depending upon the type of treatment it requires. If moved to the anodizing

tank, caution must be exercised in lowering the load in order that the buss bars at the end of the load frame engage clips on the end of the tank so that good electrical contact can be assured. Corner guides on the tank assist in lowering the frame to the proper location. After the load is in place, the operator steps to the master control panel and turns on the 25 kv_a d-c generator and rheostat and increases the voltage from

zero to 40 volts at a rate not exceeding five volts per min, and after attaining 40 volts, it is held at that point for 30 min. Dilute chromic acid is used for the electrolyte, and the work holders form the anode through their contact with the copper pipe, and the tank itself the cathode. When the current is turned on the anodic process begins to deposit a protective oxide film electrically on the metal; a film which passivates the surface of the metal, rendering it impervious to corrosive action, and forming an excellent adhesive surface for paint.

After aluminum work holders have been immersed



Load frame on dollies ready for delivery to paint shop.

in anodizing solution they must be stripped of the chromic acid coating which has been deposited on them by the electric current, otherwise they will not be suitable for future use because little or no current could pass from the work holders to the work itself on account of the contact resistance provided by the coating. To remove this coating, the work holders are immersed in a strong caustic soda solution, followed by a thorough rinse in cold water and finally, a nitric acid neutralizing dip.

If the load had been moved to the chromatizing tank instead of the anodizing tank, it would have been lowered into the tank, allowed to remain five min, and then removed to the rinse tank, where it is thoroughly rinsed. An anodized load is also thoroughly rinsed, after which it is allowed to drip for a minute and is then lowered into the drying tank where it dries for 10 to 20 min, after which the load is placed on dollies to be wheeled to the paint shop.

Fundamentally the same equipment was required for all the tanks, i.e., the size, heat requirements, and agitation of the liquid. The tanks are 14 ft long, 4.0 ft wide and 5.5 ft deep, made from 0.312 in. sheet stock, reinforced along the top edge to prevent bulging when filled with liquid by a 4.0 in. by 4.0 in. by 0.5 in. angle with 4.0 in. by 0.75 in. flat bar welded to the top flat leg of the angle. Bending stresses in the reinforcing angle calculated by using formula for uniformly loaded beam supported at each end and the weight being one-half the weight of the tank contents. Two 3.0 in. I-beams are welded to the bottom to keep the tank off the floor. All areas of all tanks not under liquid are painted a heavy coat of red lead and bitumastic paint.

The depth of the tanks required sinking them in a pit in the floor deep enough so the top edge of the tanks would be 42 in. above the floor. They are arranged in the order of operation sequence, that is, a cleaner tank, a hot rinse, anodizing, chromatizing, hot rinse and a dryer. The tanks sit as close together as possible and align themselves along their length. All pumps, operating equipment, controls, drain pipes, etc., are in the pit at one end of the tanks. Steel grating surrounds the edge of the pit and tanks to keep the

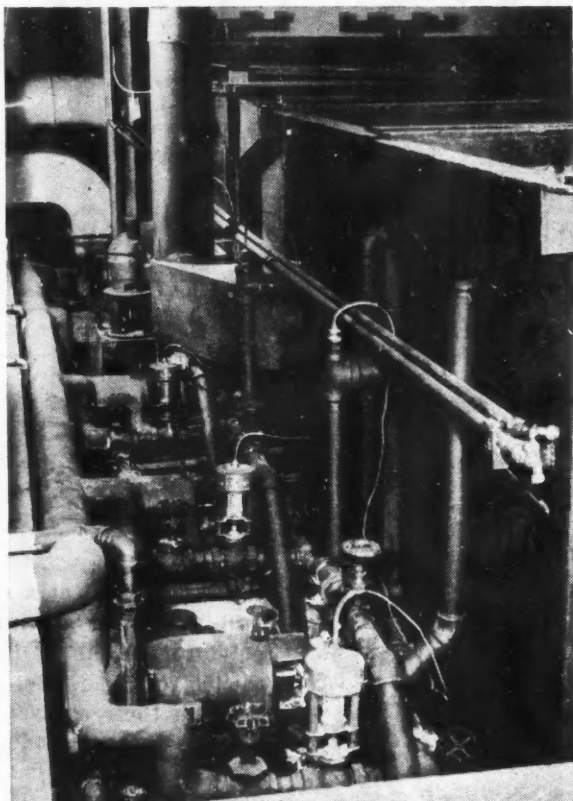
operator's feet dry. All overflow, splash and wash-down water, falls into the pit and is channeled to a sump from where it is pumped by an 0.75 hp centrifugal sump pump into the sewer.

As a large supply of steam was available it was decided to use it for heating the tank contents. The tanks being long, it did not seem advisable to heat the contents with just one coil because near the end

of the coil the heat would not be as intense as at the beginning. It was therefore divided into two separate sections. One and one-half in. coils of seamless steel pipe, welded, and with fabricated return bends were laid flat on the bottom of the tank; each section heats one-half of the contents. They are connected to a header which is supplied steam through a thermostatic valve. Each coil discharges its condensate through its own trap to the condensate return line. The required length of steam coil was calculated by the formula given in the Crane Co. catalog No. 41 for heating liquids by steam coils. One and one-half in. pipe requires 2.01 lineal ft per sq ft, therefore 98.8 lineal ft are required per tank. The coils loop across the tank instead of lengthwise. This method prevents the formation of convection currents upward from the pipe and toward the comparatively cold side walls, carrying with them any scum forming material which will separate in the eddies and pack against the walls. The removal of a load of work from such a solution will create a disturbance of the surface and cause some of the scum to dislodge and go back into circulation.

Even temperature distribution and fluid agitation is necessary. This is usually accomplished by air jets, which is a costly method. An abundance of air was not available so some other method was necessary; consequently it was decided to use a 100 gal, 45 ft head, 1.5 hp Worthington centrifugal pump which provides adequate agitation. Two one in. pipes 16 in. apart and feeding from a 1.5 in. header, which is connected to the discharge side of the pump, extends the full length of the tank under the steam coils. In each pipe, equally spaced and staggered are five one-quarter in. pipe bushings; the pump forces the liquid up through

(Turn to page 85, please)



Pumps are located in pit at rear of tanks. The chromic acid fumes exhaust stack and tank overflow drains are also shown in this photo.

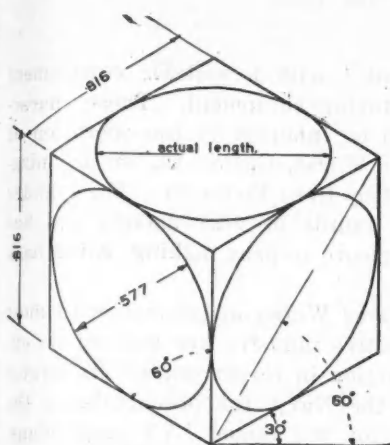


Fig. 1—Basic principles of isometric drawing are indicated in this representation of a cube.

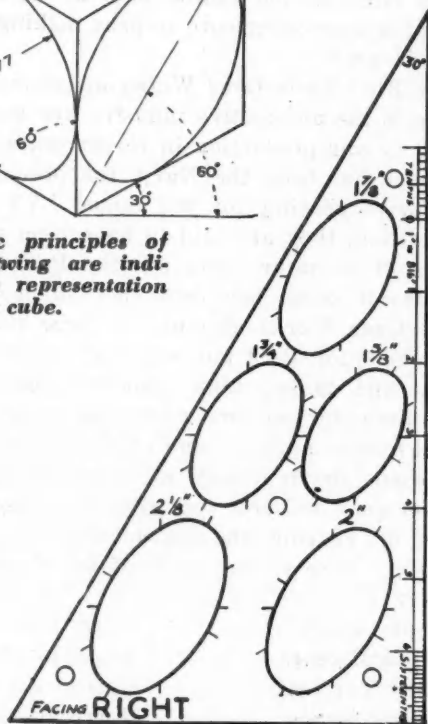


Fig. 2—One of a group of templates for drawing ellipses within a standard range of magnitude.

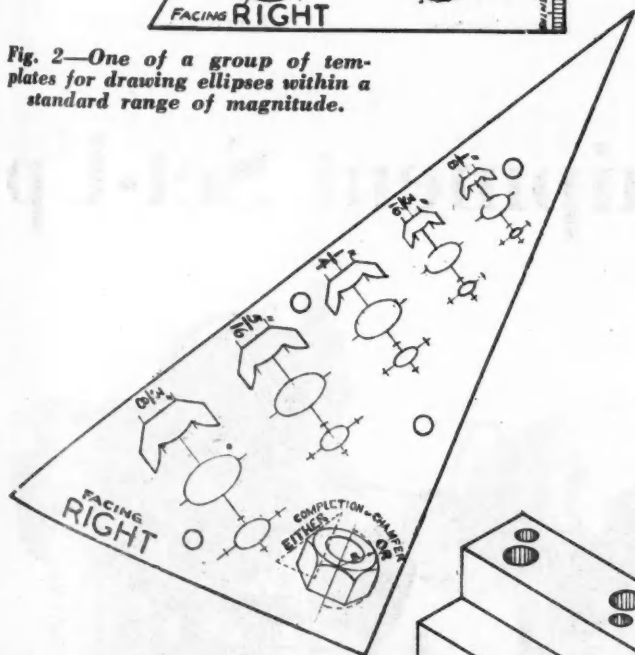
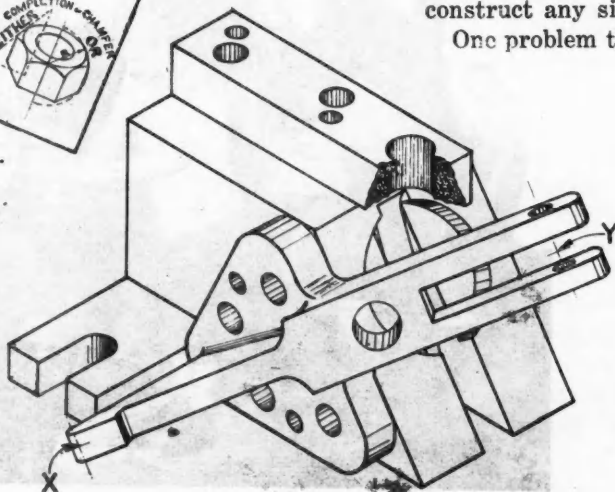


Fig. 3—Template for drawing hexagon nuts and bolt heads. The diagram in the 90 deg. corner shows alternatives for completing the chamfer.

Fig. 4—An intricate drill jig drawn isometrically by the Leete system.



Leete System of Isometric Drawing

A SYSTEM for producing isometric views, that obviates the need for either artistic perception or ability in freehand drawing, has been evolved by a British engineer. This system provides a pictorial representation of a component as though viewed through a long range camera; i.e. with the back as large as the front. The lack of true perspective makes it possible to adopt a standard foreshortening, which in turn finds expression in the use of a standard isometric scale of one in. to 0.816 in.

The basic principles involved are indicated in Fig. 1, which shows a cube with the nearest and farthest corners in line. All sides are equally foreshortened and their lengths can be read off to the scale just mentioned. The ellipses are all of the same magnitude, the major axis relative to the minor axis being as 1 to 0.577. Since it is not easy to draw ellipses quickly and accurately freehand, and owing to the fact that most engineering work is covered by a standard range of sizes of holes, nuts, etc., a series of templates in the shape of 60 deg triangles has been prepared for the use of draftsmen. One of these for elliptical holes is shown in Fig. 2; their use reduces the process of drawing an ellipse at the required angle to the simplicity of drawing a circle.

Templates (Fig. 3) are also provided to facilitate the drawing of hexagon nuts and bolt heads. As in the case of the ellipse templates, they cover the sizes in common use. For odd sizes a table of equivalents is provided, enabling the draftsman to construct any size accurately and quickly.

One problem that may arise when making an isometric drawing occurs when ellipses are required to depict holes, bosses, etc., placed at odd angles as shown in Fig. 4. It is for use in such circumstances that a chart has been prepared. It enables the draftsman to lay out angles and ellipses that occur when one or more faces are at odd angles to the remainder. The Leete system has been developed by the Pictorial Engineering Drawing Co., Meriden, England.

GEAR making has made tremendous strides in recent years, not only in design but in manufacturing practice and equipment. Current advances make it possible to produce gearing capable of carrying heavier loads at higher speeds with smaller and more compact gear sets, possessing much longer life. On the other hand, with the passing of time industry has demanded a wider variety of types of gears in an endless range of sizes, thus making the job of the gear producer increasingly complex.

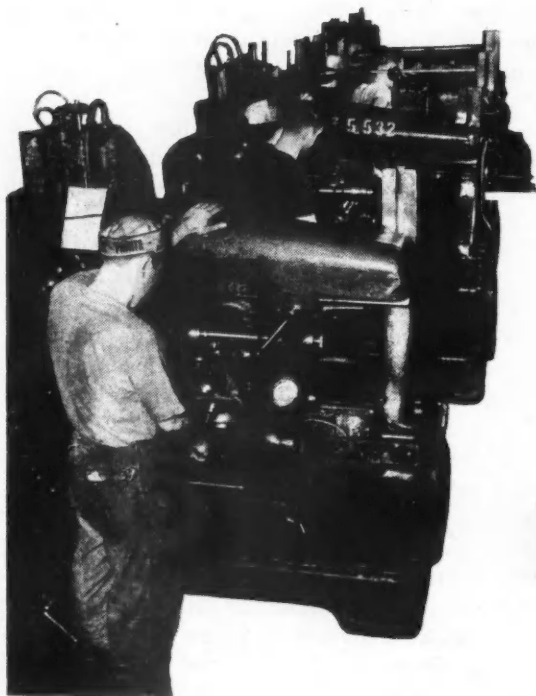
What we are getting at is that today the gear specialist who seeks to serve industry must have a complete knowledge of all of the varieties of gears in demand, an essential know-how in engineering and

manufacturing, coupled with a suitable complement of flexible manufacturing equipment. These characteristics are said to be inherent in the operation of the Brad-Foote Gear Works, Cicero, Ill., an organization founded in 1924 by Brad-Foote, Sr. The founder comes from an old family of gear makers and has had a life-long experience in gear making, going back some 57 years.

The Brad-Foote Gear Works in common with most others in the automotive industry has devoted its energies to war production in recent years. Its largest customer has been the Navy, the product being the final drive gearing for the famed LVT amphibians. In addition, they are said to have been the first producers of actuator parts for the B-29, such as the mechanical bomb bay door mechanism. The Brad-Foote Gear Works also makes large turret gears—502 teeth—for B-29 gun mounts; gears for military trucks and tanks; tank sprockets for the British; gears for radar equipment; timing gears for two-cycle Diesel marine engines; and other products.

Perhaps the best way to visualize the complexity of this gear maker's specialty is to list the normal range of gearing the organization is prepared to produce. Here is the scope of the Brad-Foote Gear Works:

Spur gears	Worm gears
Helical gears	Spiral bevels
Straight bevels	Hypoid gears
Skew bevels	Herringbone gears



Part of a large battery of modern heavy duty hydraulic gear hobbers of familiar Barber-Colman make.

These large Fellows gear shapers form part of a large battery of Fellows equipment of various types and sizes, including the latest No. 7 high speed machines.



Equipment Set-Up

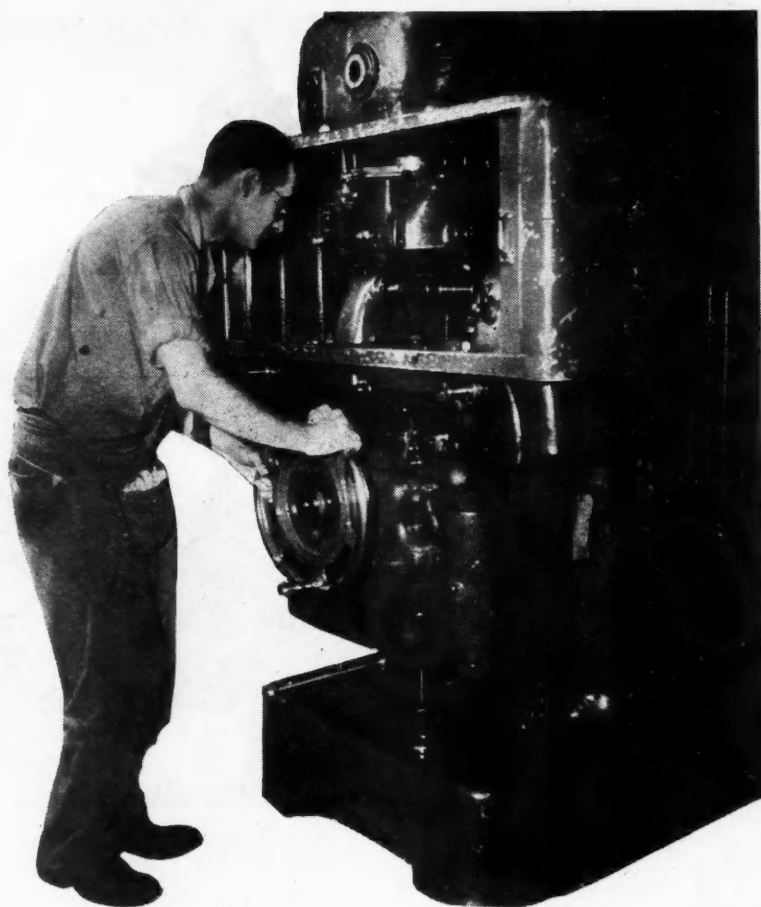
One of several Red Ring gear shaving machines used for the shaving of timing gears and other gears for which shaving is specified by the customer.

By

Joseph

Geschelin

This is the 111th
in the series of monthly
production features



at Brad-Foote Gear Works

Internal gears

Speed reducers: spur gear, bevel gear, worm gear, helical gear, herringbone

To add further to diversification, the company recently announced the introduction of a unique type of hydraulic clutch and speed control unit for application on industrial mechanism and for automotive vehicles. A feature of this device is the use of gear type pumps for the basic mechanism.

The fact that every type of gear can be produced does not give the whole story, for gears must be made in an amazing variety of sizes to suit the needs of many users. Some idea of the range of such requirements may be gained from the record. The smallest gears made here are for radar equipment— $\frac{3}{8}$ in. in diameter; the largest that can be produced is one about 108 in. in diameter with a weight limit of five tons.

Flexibility is strained by another consideration. Not all users require gears in large quantities. Some

To Make All Types of Gears in Wide Variety of Sizes

are mass producers and order gears in enormous quantities, making possible continuous straight line production. Many others require smaller quantities; some need only a few. These variations in demand imply the ability to handle both mass-production and short runs simultaneously and oftentimes over much the same equipment.

Depending upon the nature of the application, modern practice imposes other requirements. For example, the timing gears for the marine Diesel engine mentioned above must be shaved after cutting the gear teeth. The same is true of automotive transmission gears. On the other hand, certain types of gears are ground or lapped. Each individual specification must be translated in terms of a sequence of operations over suitably selected equipment.

Considering the intricacy of the plant operation



(Left) The familiar Geargrind machine is used for grinding spur gears, as shown, and can be used for grinding splines.

(Below) Among the latest additions to the screw machine department is this six-spindle National Acme-Gridley automatic.

(Bottom) Part of a large group of Gleason generators of many types and sizes, capable of handling the bevel gears and hypoid gears.

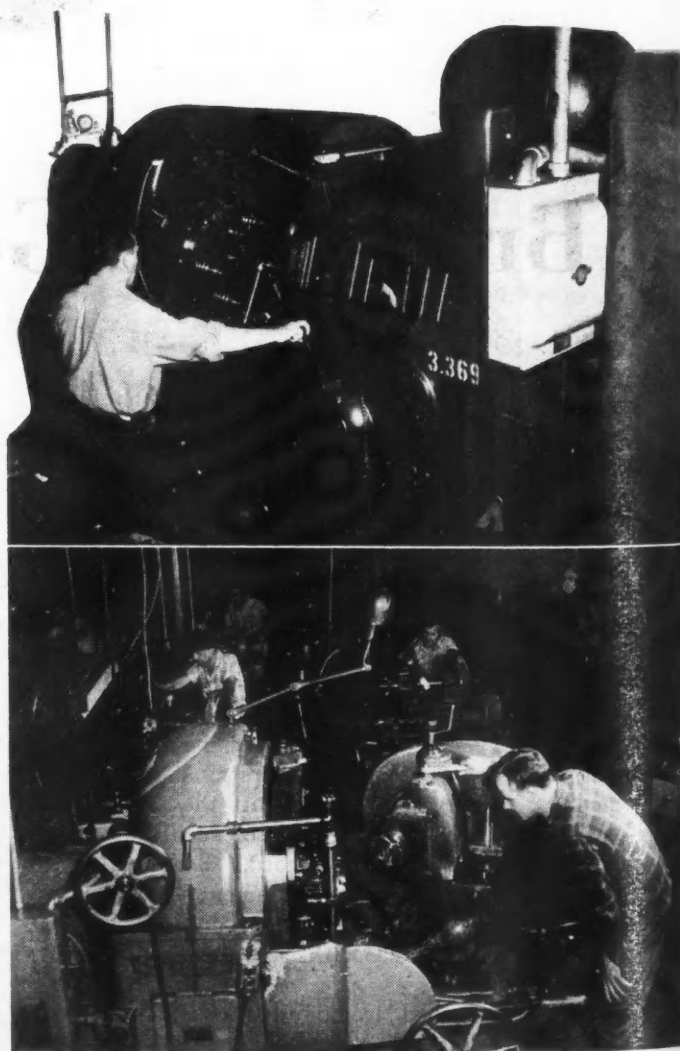
involved here, it is obviously quite beyond the scope of this article to follow the pattern of production for even a sampling of cases. The writer feels that our readers can readily visualize what can be done with certain facilities for gear making and, accordingly, will confine the discussion to an outline of the character of the equipment available in the plant.

Let us consider the facilities in terms of machinery for cutting gears, for gear finishing, and by departmental set-up for other types of operations such as turning, grinding, heat treating, etc.

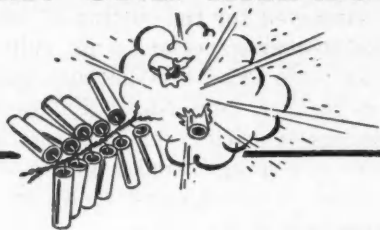
GEAR CUTTING DEPARTMENT—Here will be found a wide range of Gleason generators for the cutting of bevel gears—straight, spiral, and skew types. Among the Gleasons are the most modern machines for cutting hypoids, including the latest type of roughing machine for hypoids and bevels.

A large battery of the latest type hydraulic Barber-Colman hobbing machines is available for cutting splines and gears. The range of hobbing splines and gears of various types is further extended by the battery of Gould & Eberhard single-spindle hobbors in a wide range of sizes, including a special machine for cutting spur gear racks. There is also a Newark gear cutter for large wheels up to 72 in. diameter and enormous bevel gear planers taking gears up to 60 in. diameter.

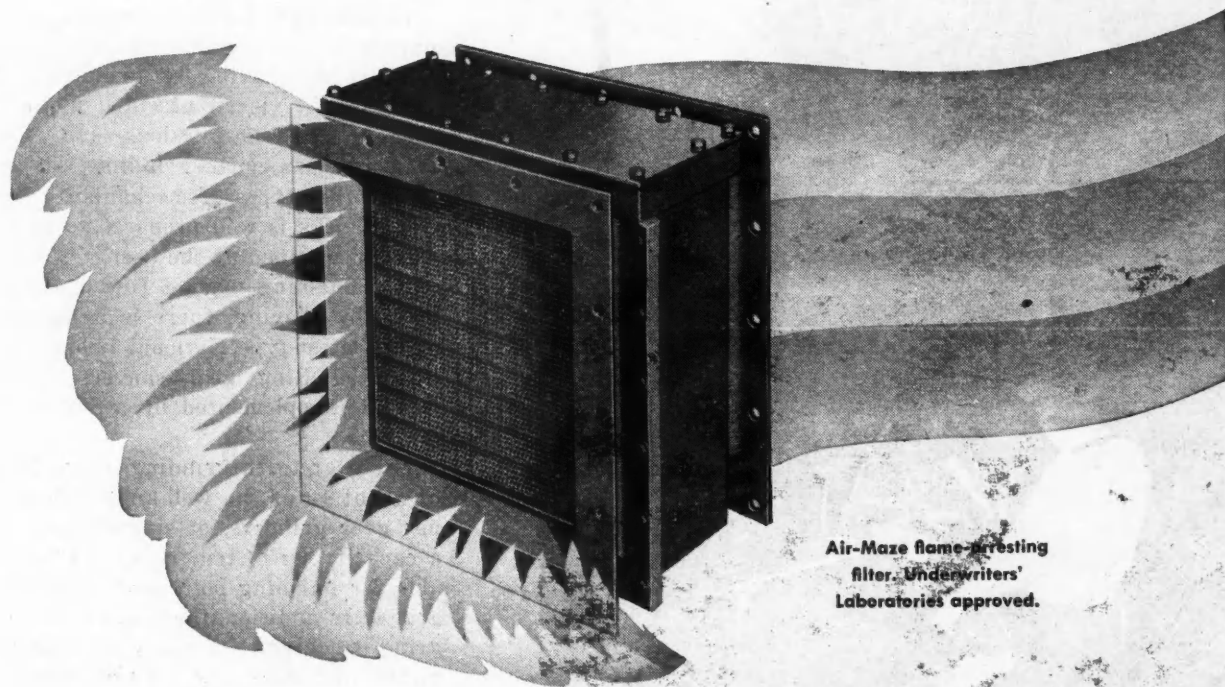
Herringbone gears in a wide range of sizes are produced in the two basic types—conven-



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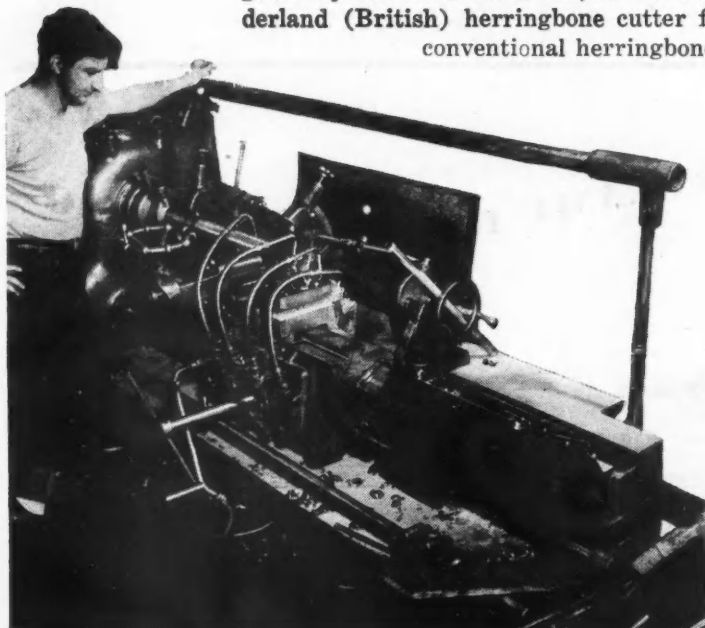
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- Gear case, crankcase and tank vent breathers
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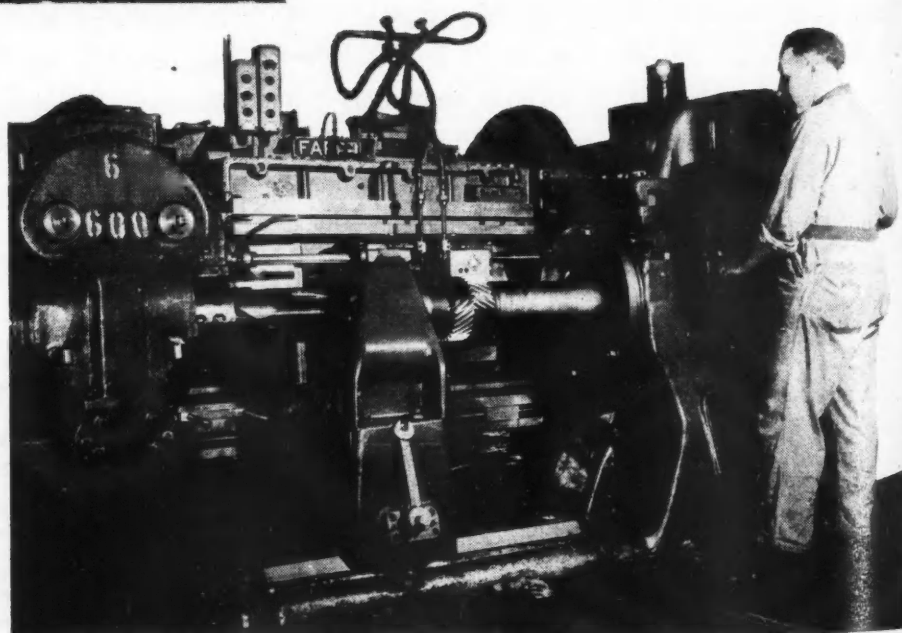
tional, and the Sykes gear under license from Farrel-Birmingham. They have several Sykes gear cutters which can take gears up to 60 in. diameter; and a Sunderland (British) herringbone cutter for conventional herringbones.



(Top) For handling a large variety of long shafts and similar parts, the company has a number of the well-known 8 in. Lo-Swing automatic lathes.

(Above) The lathe department boasts many types and makes of machines, one example being this 14 in. Lodge & Shipley manufacturing lathe.

(Right) Sykes herringbone gears up to 60-in. diameter are cut on Farrel-Birmingham machines such as this one.



The versatile Fellows gear shaper method is employed for the cutting of internal gears, helical gears, special forms, splines, shoulder gears, etc. For this purpose there is a battery of the new No. 7 Fellows' high-speed shapers, a battery of older machines of the same size range; and a group of four large Fellows' gear shapers of 36 in. and 48 in. capacity.

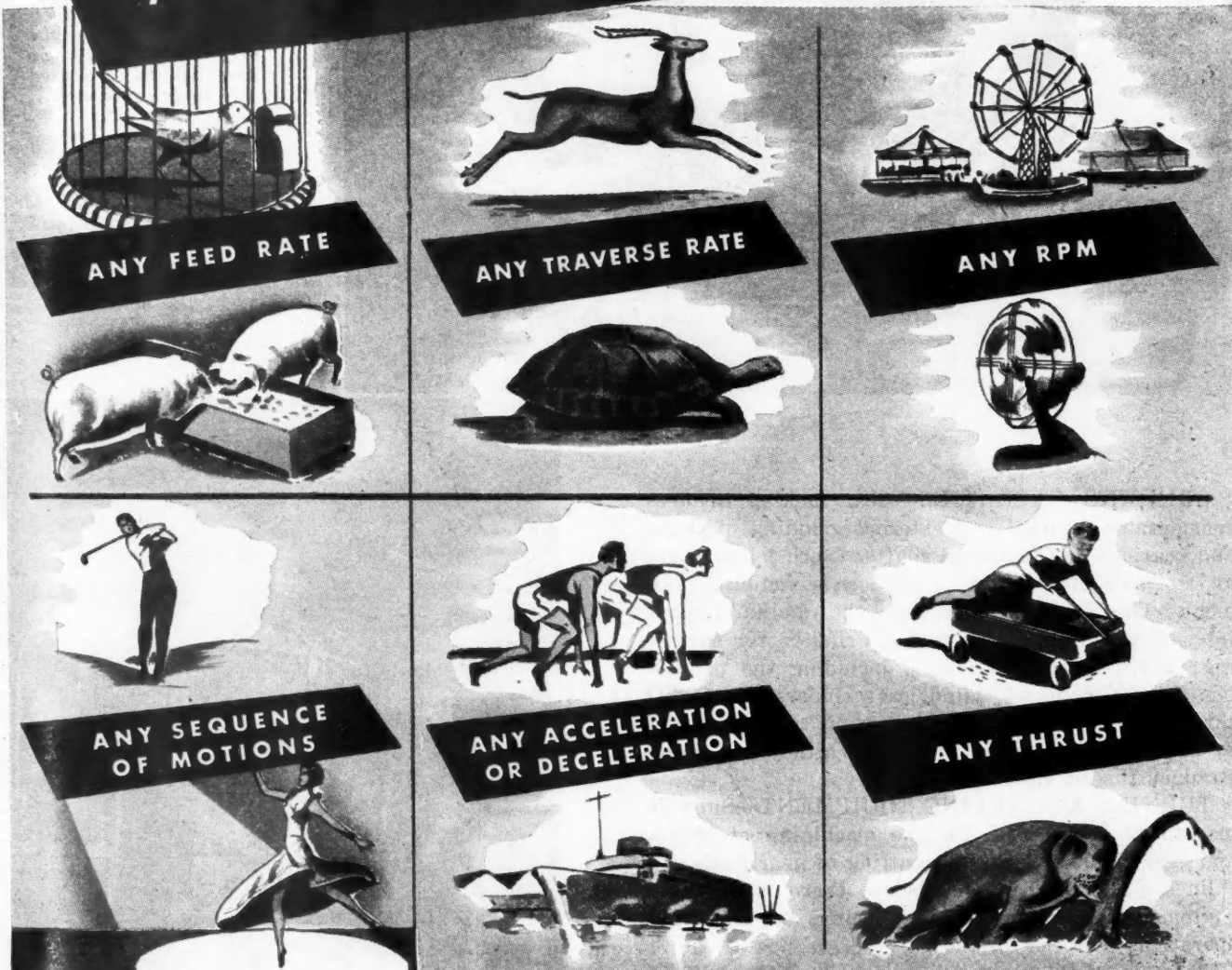
It can be seen from the above that Brad-Foote Gear Works has adequate machinery in the form of gear hobbers, shapers, generators, planers, and herringbone cutters to handle the gamut of gears demanded by industry today.

GEAR FINISHING—Depending upon the nature of the application, modern gears are finished by shaving or grinding. Although gear shaving is an accepted method in passenger car transmissions and most truck transmissions, gear grinding is required on many other types of mechanism. Brad-Foote Gear Works is well prepared to finish in any manner specified by the user.

For finishing marine Diesel engine timing gears by shaving, there is a battery of two of the latest type National Broach & Machine Co., Red Ring gear shavers. This equipment is supplemented by a Fellows' shaving machine.

For gear tooth grinding, there is a battery of about 12 of the well-known Pratt & Whitney gear grinders, of single-wheel type, with a capacity up to ten inches. These are suitable for finishing both spur gears and helical gears. In addition, there is a battery of Gear-grind machines for tooth grinding of spur pinion and gear sets. Then there is special equipment for grinding worm gears. In this group is a David Brown (British) worm thread grinder; and a battery of Pratt & Whitney worm grinders.

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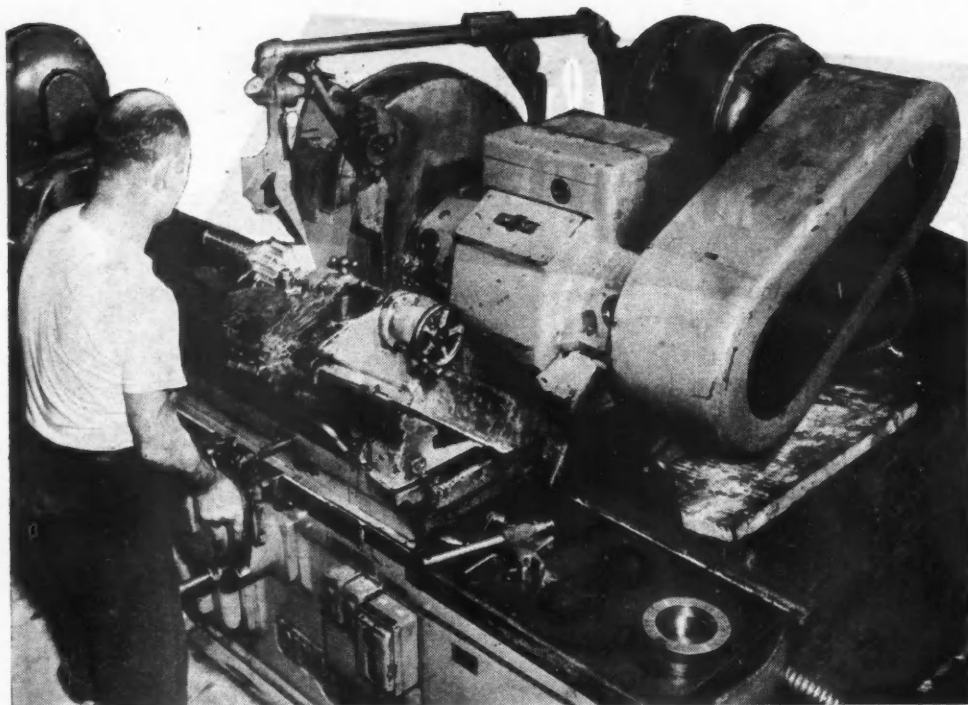
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(Left) This Cincinnati cylindrical grinder is typical of the modern grinding equipment found in the plant.

(Below) A towering 8-spindle Bullard Multi-Au-Matic is employed for the turning, boring, facing, and other operations required for the preparation of large gear blanks produced in large quantities.

(Bottom) Heald internal grinder, shown here, is one of various types of internal grinders found throughout the plant.

GRINDING FACILITIES—Gear making involves considerable internal and external grinding of bores and bearings and faces and shafts. Such jobs require an adequate installation of modern grinding equipment. This department features the familiar Bryant internal grinders; Heald rotary grinders for surfacing; Heald internal grinders, including the popular No. 72A; Cincinnati cylindrical grinders; Ex-Cell-O thread grinders. In this category, it may be fitting to include a battery of Pratt & Whitney and Lees-Bradner thread millers.

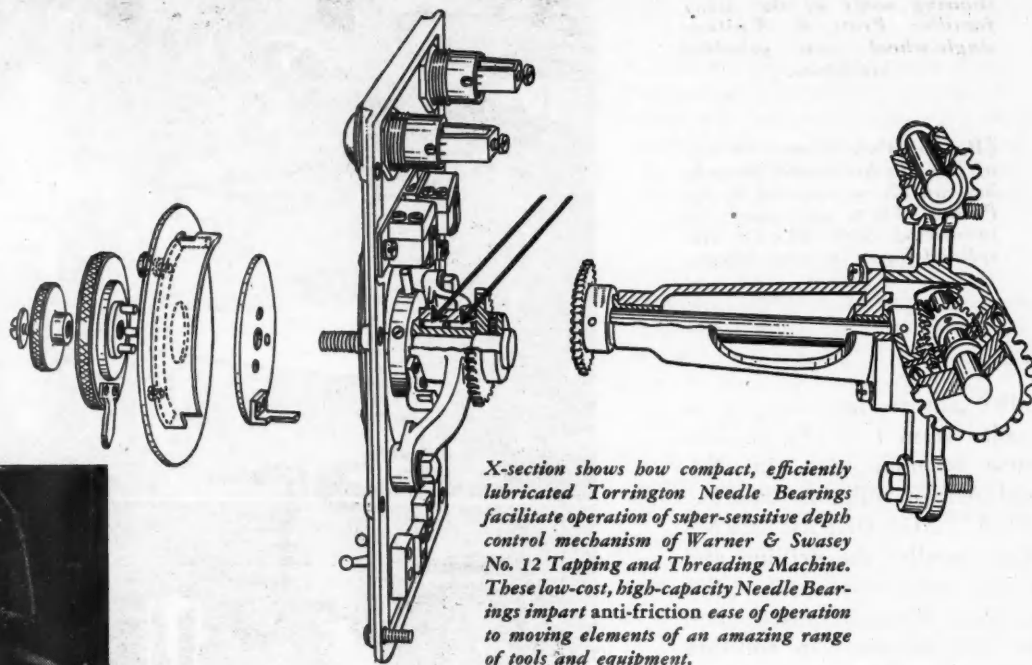
TURNING AND BORING EQUIPMENT—Suitable machinery is essential for the machining of shafts and gear blanks prior to the cutting of gear teeth and splines. As will be noted below, there is adequate equipment for turning, boring, facing, and the other operations required for the purpose.

Throughout the plant will be found a large battery of Bullard V-T-L's for turning and boring; also a high production eight-spindle Bullard Multi-Au-Matic for large runs such as for timing gears. Among the other large turning and boring equipment suitable for out-size gears is a Cincinnati Hypo which has a capacity up to 84 in. OD.

Lathe equipment encompasses the full variety of engine lathes, automatic lathes, turret lathes. In this group are found the following: Lodge & Shipley 14 in. manufacturing lathes; Fay automatics; Lo-Swing 8-in. automatic lathes with a long bed to accommodate large work and long shafts; a wide range of sizes and types of Warner & Swasey turret lathes; and Bullard V-T-L's ranging from 24-52 in. capacity.

A large department is devoted to the automatic screw machines which are used for turning and forming a variety of parts and small gear blanks such as bevel gears, for example. In this group are a large number of Cleveland automatics and National Acme.





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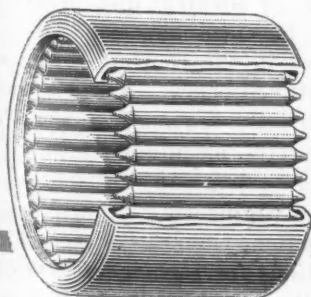
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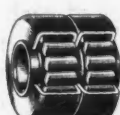
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TORRINGTON NEEDLE BEARINGS



(Right) Here is a section of the gear grinding department, showing some of the many familiar Pratt & Whitney single-wheel gear grinding machines.

(Below) Partial view of one of the big horizontal broaching machines supplied by LaPointe. These are used for producing both plain and splined bores in gear blanks.

Gridley automatics, ranging in capacity from 1 to 4½ in., and a new 6-spindle, 3½ in. National Acme-Gridley automatic.

DRILLING DEPARTMENT

—This handles the drilling and tapping operations required for the completion of parts and gears and shafts. In addition to the equipment listed below, this department also contains benches for burring and hand grinding and detail finishing operations.

Among the equipment in this group are the following: Natco multiple spindle drills; several American 5-ft Radial Drills; Leland-Gifford four-spindle sensitive drill presses; Bakewell external lead screw sensitive tappers; and one Haskins tapping machine.

MILLING DEPARTMENT—

This is a self-contained department to which are routed the parts requiring milling operations. Here will be found a group of some 16 or more of the familiar types of modern milling machines, including Cincinnati, Kearney & Trecker, and Brown & Sharpe mills of horizontal and vertical styles. This department also boasts a fine Pratt & Whitney jig borer.

Apart from the items of equipment enumerated above, the plant has a number of small LaPointe horizontal broaching machines; and a large new LaPointe horizontal hydraulic broaching machine capable of broaching the plain or splined bores in large gear blanks.

This round-up may be completed by noting an excellent and self-sufficient heat-treating department with equipment capable of handling the variety of heat-treating operations required.

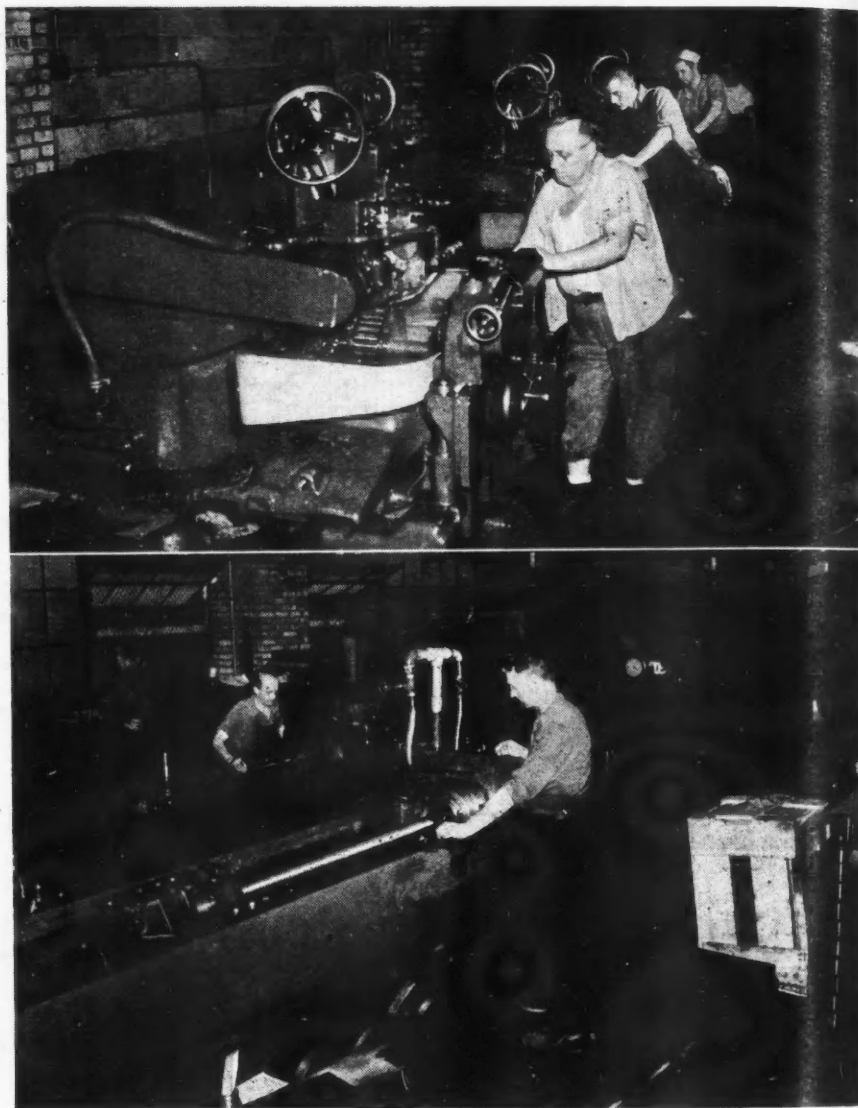
Finally it may be noted that the facilities are rounded out with a gear laboratory, final inspection department responsible for quality control, and Magnaflux inspection equipment for use where specified.

Now that we can visualize the departmental set-up of this plant, it can be readily seen that the extreme flexibility so essential in the over-all operation is

achieved through skillful production planning and routing. The scheduling of any piece can be handled—either in small lots or in continuous runs—by routing over suitable equipment department by department without tying up any important job. Similarly by careful planning it is possible to arrange for long runs with the economy of straight-line production without re-arrangement of machinery.

This is well illustrated in the routing of the several production gears outlined below. It will be noted that the routing gives only the sequence of operations and does not list the specific machines on which an operation should be performed. In explanation of this, it is noted that the engineering department, in cooperation with production planning, develops the exact sequence of operations for each individual part. The "Travel" card resulting from this study is supplied for each departmental foreman. It is the function of the foreman to route the work in his department in accordance with the availability of machine hours of each type of machine. In essence, this gives the department manager a free hand in the utilization of machine capacity, assures a free flow of

(Turn to page 78, please)



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It is reported that

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Three iron companies are co-operating in a joint photographic aerial survey of the Marquette Range as an aid to more detailed exploration. *Engineering & Mining Journal.*

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A new electrical instrument is said to be so sensitive that it can measure movements as small as one ten-millionth of an inch without touching the object. *Battelle Memorial Institute.*

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A scientific journal reports that a new type of mechanical refrigerator, employing a high-speed rotor as its only moving part, can produce temperature drops as great as 220 degrees and can, by modification, be used as a heat pump for such purposes as the heating of homes in winter. *Journal of Applied Physics.*

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Stainless steel is being made for a black surface finish suitable for the bottoms of cooking utensils and for many applications where reflections or glaring light are a disadvantage. *Business Week.*

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The announcement by one radio manufacturer of a new set not much larger than a package of cigarettes is expected to be followed by a rush of similar announcements by other manufacturers. *Sentinel.*

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Prisoners of war are constructing a model of the Mississippi River drainage area to permit the study of complex problems of drainage for the co-ordination of flood control measures. *Engineering News Record.*

The Great Lakes Research Institute has been organized to do for these inland seas what the Woods Hole Oceanographic Institute has been doing for the Atlantic.

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The Army is packing guns and other weapons and surplus material in steel or aluminum "cans", in an atmosphere of nitrogen, for storage. *Air Technical Service Command.*

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Stainless steel can now be cut with an oxy-acetylene torch almost as easily as mild steel. *Air Reduction Sales Co., Rustless Iron & Steel Corp.*

To aid the war-to-peace reconversion of scientific research, the Senate's subcommittee on war mobilization recommends that Congress create a National Science Foundation as an independent government agency.

get ready with CONE for tomorrow

Power steering, which has been discussed speculatively for automobiles, is being used on one model of dump truck. *Heil Co.*

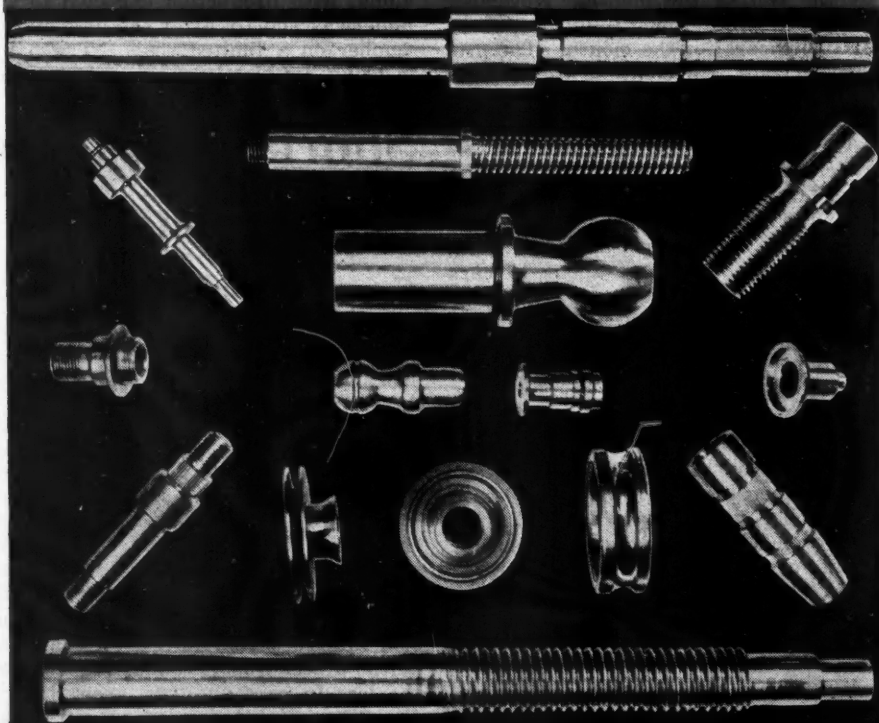
get ready with CONE for tomorrow

America's first jet-propelled plane is now a museum piece at the Smithsonian Institution. *Science News Letter.*

get ready with CONE for tomorrow

A new portable hardness-testing hammer is spring-operated and, being portable, can be used to test pieces of metal of any size, anywhere. *Steel City Testing Laboratory, Detroit.*

The 6-Spindle Conomatic will keep you ahead in the production of parts like these.



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

23

Most Companies in Industry Now in Production of Cars to Some Degree

All Factories Expected to Be Running Within a Very Short Time Despite Labor Trouble and Material Shortages

While still beset by labor troubles and shortages of materials, the automobile industry is beginning to bring order out of the chaos of reconversion. Most of the companies in the industry already are in production of cars to some degree, and all of them will be running within a very short time.

Here is how the situation shaped up about Oct. 20 when newsmen from throughout the country visited automobile manufacturing plants in the Detroit as part of a nationwide tour to study reconversion.

All General Motors divisions were in production. Buick was operating at a rate of 100 cars per day, with production expected to step up to 200 daily by the end of the month. November schedules call for 500 daily or a total of 10,000 cars for the month. The production rate will continue to climb to a peak of 1800 cars a day, which is expected to be reached by next March. (All production estimates given in this article are based on the assumption that labor and materials troubles will not interfere.)

Cadillac started operations in mid-October at the rate of about 15 cars a day, and expects to build about 5000 cars this year. Production will reach 320 a day by March, with output the first full year expected to hit approximately 60,000.

Production at Oldsmobile started Oct. 15 and output was crowding 100 cars a day by the end of the first week. The division planned to build 2500 cars in October, and to double production in November and again in December. A rate of 1300 cars per day is expected to be attained by next March.

Pontiac Division was clipping along at 150 cars per day on Oct. 20, with plans to double output in November and to triple it in December. Production is expected to hit 30,000 cars a month in February, or 1800 per day.

Chevrolet Division, which heretofore has been extremely secretive, announced that it had completed about 1100 cars by Oct. 20, and expected to build more than 9500 before the end of the month. Production schedules call for 19,000 cars in November and 40,000 in December. Truck schedules envision

23,000 units in October, 41,000 in November, and 44,000 in December. If schedules are met, the division will turn out just short of 240,000 cars and trucks this year. The 11 Chevrolet assembly plants are tooled for a post-war peak of 450 cars per hour, or more than 7000 per day when working two eight-hour shifts. Although the division was behind its October schedules because of labor troubles in suppliers' plants it expects to be up to schedule before the end of the year.

At Plymouth Division of Chrysler Corp. production had not yet started, but several cars in various stages of assembly were on the newly completed assembly lines. Reconversion is well along, with production expected to get underway shortly after the first of November on a limited scale. The plant is being completely revamped, and not

one machine will stand in the same place it was before the war. The two assembly lines will be one-half mile long each, and the plant will have capacity of 3 cars a minute when in full production. One line will be run two shifts, and the other one shift, according to present plans, making a total daily output of more than 2100 cars per day. The Evansville, Ind., and Los Angeles plants will add another 1000 cars per day, so that at the peak the division can turn about 3000 automobiles daily. The engine plant now is in operation at about 2000 per day.

No report was forthcoming on other Chrysler divisions, other than that they are in about the same relative position as Plymouth. K. T. Keller, president, stated that the corporation will spend \$57 million on getting facilities rearranged for car production and another \$18 million on additions to existing plants. The job will require installation of 70 miles of conveyors, 3100 linear ft of spray booths, and 8500 ft of drying ovens. In addition more than 18,000 machines used on war work must be reconditioned. The company has purchased 974 machine tools from the government and must buy 1256 new

(Turn to page 106, please)

Shortage of Coke will Result in Reduced Steel Mill Output

Current Shipments of Flat Rolled Steels to Automobile and Parts Makers Thought to Represent Peak for 1945

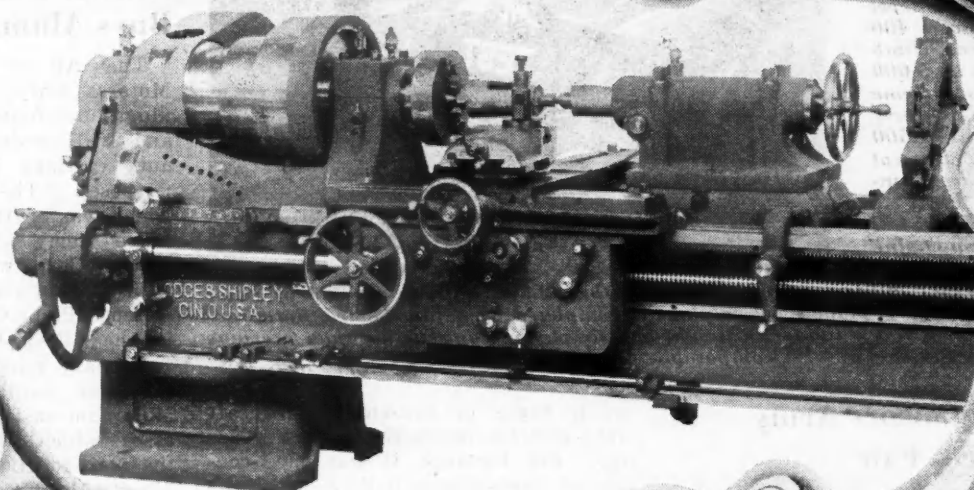
By W. C. Hirsch

Activity of automotive consumers in the metal markets continues to be highlighted by efforts to drive in deliveries of hot and cold rolled sheets and strip. Reports of strike threats in this or that field, which may affect the flow of supplies adversely, have grown in number to the point where they benumb rather than startle. The bituminous coal miners' strike is a good example. With winter just around the corner, the loss in coke supplies, even though the miners have decided to return to work, is certain to make itself painfully felt in the steel mill output during the next few months, but amazingly light-hearted views of the outlook are much more often encountered than are expressions of uneasiness.

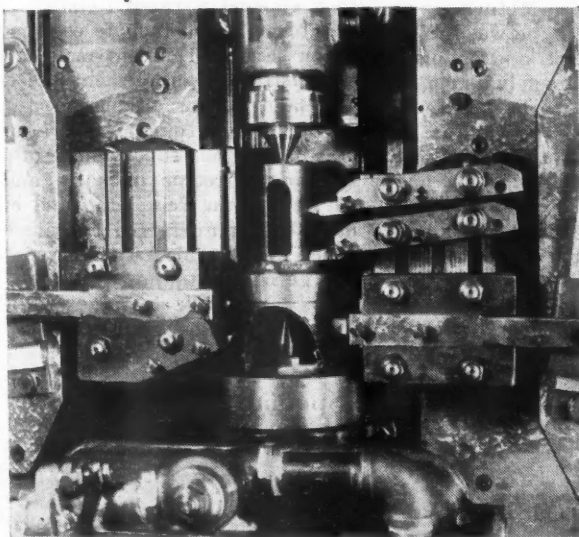
Current shipments of flat rolled steels to automobile manufacturers and parts makers are thought to represent the

peak of the movement for 1945, with some mills making it plain to consumers, other than those whom they served before the war, that they can not count on shipments before spring of next year. There is still considerable talk of this or that buyer having placed orders for his requirements with more than one mill in the expectation of being able to cancel commitments for what he may not be able to use. What the old-established steel producers are striving to accomplish is to rebuild their pre-war trade, and in the present stringency of the supply not to divert any of their output to quasi-speculative purchasers. In this connection it is reported that a number of producers, who formerly supplied non-integrated mills with semi-finished material, have let it be understood that they will discontinue such sales, preferring to supply

(Turn to page 108, please)



HOW WELL CAN A 1917 LATHE *Do Today's Valve Jobs?*



L & S Engineers will gladly give you a practical demonstration of Duomatic superiority on your own work. There is no obligation. Write for detailed literature No. 601 and No. 620 on 2A and 3A Duomatics.

● Imagine the old-fashioned lathe above being used on a tough chrome nickel alloy steel valve. Limited to a few feeds and a single tool, separate settings were required for straight and taper turning. In those days it took a skilled operator considerable time to turn a valve job.

Obviously, this lathe would be completely inadequate for a shop requiring high output, precision work, and low costs. Yet lathes even a few years old may be almost as obsolete—when placed alongside the new 2A or 3A Duomatic, Lodge and Shipley *full automatic* lathes.

Consider the valve plug at the left done on a 3A Duomatic. Multiple tools perform all straight turning operations at one time, front and rear, and taper turning front and rear—simultaneously. The set-up for two tapers is easily converted to set-ups for tapers of different sizes. An unskilled operator can turn out precision valve parts quickly and economically.

Dual tool slides—front and rear—operate singly or together . . . can be used for a wide range of cycles in turning and in straight and angular facing operations. A Duomatic is like two lathes in one. It may actually equal several of your old or pre-war models in total output, plus quality and accuracy never before obtainable.

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MACHINE TOOL DIVISION, 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION, 800 EVANS ST.

November 1, 1945 When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

Grumman F-8F Bearcat

This light - weight, single - engine, carrier - based plane is the latest fighter to be developed for the Navy. Its sea level speed is over 400 mph. It can climb more than 5,000 fpm and its extreme range under ferry conditions is 1,500 miles. The Bearcat is powered by a single - stage Pratt & Whitney 2800 - C Double Wasp engine which develops

2,100 hp under military rating and better than 2,800 hp with the aid of water injection. The new plane's power plant is completed by a four-bladed Aeroproducts propeller which is lighter in weight and simpler in construction than previous comparable propellers.



ATSC Sponsors Army Air Forces Fair

Hundreds of aeronautical developments emanating from Wright Field, headquarters of the Air Technical Service Command with its \$150 million worth of engineering equipment, were displayed there in October at the first Army Air Forces Fair. The exhibits, which were viewed by thousands of people, including engineers, company executives and Government officials from all parts of the country, were set up in tents. The fair opened Oct. 12, coinciding with the 18th anniversary of the dedication of the field, for on Oct. 12, 1927, Orville Wright raised the first flag over the field in a dedication ceremony.

The Air Technical Service Command, which for the first time fully revealed to the public the might of American air power, is responsible for the engineering, procurement, supply and maintenance of all AAF planes and equipment throughout the world. It is commanded by Major General Hugh J. Knerr.

From its headquarters at Wright Field, where the Wright brothers conducted their first experimental flights, have stemmed the mighty efforts—always in collaboration with industry—that made America the world's foremost air power.

Vast ATSC laboratories incubated and brought to maturity most of the aircraft and aeronautical equipment with which men of the AAF won the world's first air war.

Although they are the finest in the world right now, nevertheless these fighting tools will be obsolete tomorrow. ATSC engineering, always planning years ahead, will be ready with new and better ones—the result of close collaboration with the brains and experience of the world's greatest aviation industry.

The present is the future for ATSC engineers. In many cases they work on projects which cannot be realized for years. Such practical dreaming pays off, however, for the most fa-

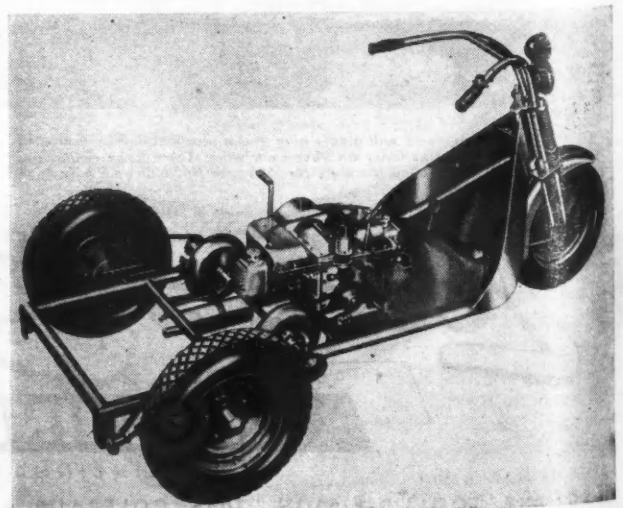
miliar types of present-day aircraft were entirely impractical a few years ago. For instance, it was once considered impossible to build a metal air-
(Turn to page 112, please)

New Assembly Plant for Lincoln and Mercury Cars

The Ford Motor Co. has purchased 78 acres of land in New Jersey, 30 miles southwest of Manhattan, as a site for construction of a new plant to assemble Mercury and Lincoln automobiles. Located in Raritan township, the property is near Metuchen on U. S. Highway No. 1 between New Brunswick and Newark and is on a branch line of the Pennsylvania railroad. The new plant, to be known as the Raritan plant, will be capable of producing 350 cars a day and will be the first plant to build Lincolns outside the Detroit area.

Construction of the 500,000 square-foot building is expected to start early next spring. The new single story structure will be of brick and steel construction and will include an attached

This 1946 three-wheeled truck, made by Toolcraft Manufacturing Co., Huntington Park, Cal., handles half-ton pay loads of 23 cu ft, and is capable of traveling 35 mph. Its two - cylinder, four - cycle, air-cooled engine develops eight and one-half hp. The Firebaugh Special weighs approximately 600 lb, is 92 in. long, 50 in. wide, has a 66-in. wheel base and a turning radius of 14 ft. Two fluid drive units are mounted on the jack shaft.



Firebaugh Special

office building. During full production it is expected to employ a maximum of 2500 workers who reside in nearby communities.

Allison Division of GM Buys Aluminum Foundry

The Allison Division of General Motors Corp. has purchased the aluminum foundry at Bedford, Ind., and will produce high grade aluminum castings for general industrial purposes. The Bedford Foundry which was operated during the war by Delco - Remy Division of General Motors Corp. was purchased complete with all plants and equipment from the Defense Plant Corp. It will be known as the Allison-Bedford Foundry.

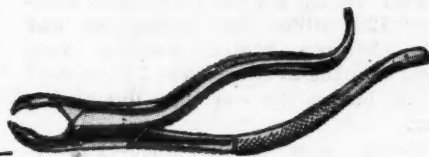
Primary purpose of the foundry is to make available to industry the aluminum casting technique and processes which were developed during the war for liquid-cooled aircraft engines. Mass production of the Allison engine demanded development of new foundry practices which would permit volume production of large complicated lightweight castings.

The Bedford Foundry which began operations early in 1943 supplied cylinder heads for liquid-cooled aircraft engines exclusively. It has produced approximately 14,000,000 lb of these aluminum castings. Rearrangements will begin immediately to convert the foundry from a single purpose to a general purpose foundry. Facilities to be added include equipment for green sand, permanent mold and plaster casting to supplement the existing dry sand casting facilities.

All Allison foundry operations will be under the supervision of E. A. Canning, director of sales and engineering. Dan Templeton and his staff have been transferred to Allison from Delco-Remy. Mr. Templeton was in charge of the foundry during the war years and will continue as Bedford Foundry Manager.

YOU GET CORROSION RESISTANCE

Plus ECONOMICAL TROUBLE-FREE FORGINGS
WITH *Carpenter* STAINLESS

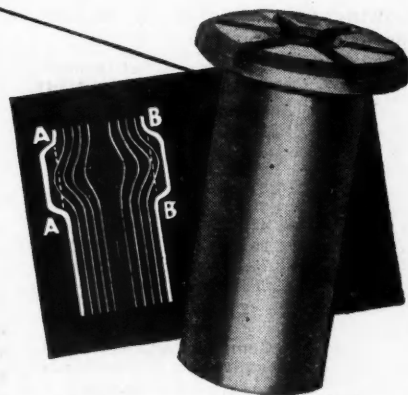


POSITIVE PROTECTION against corrosion to withstand the effects of repeated sterilization, plus the required strength and hardness, made Stainless a natural choice for this forged dental instrument. Clean, flawless Stainless forging bars reduced rejects, increased output.

If rejects run high when forging Stainless, it's time to check all along the line. Many factors must be controlled right in the forge shop. But to eliminate trouble and secure best results you must be sure that your forging bars are sound, clean and free from injurious surface defects. Such forging bars assure easiest forging operations and lowest production costs.

At Carpenter, Stainless Steels are made in a tool steel mill to tool steel quality standards. Stainless billets are disc-inspected to assure soundness and homogeneity—and are then machine-turned to remove all surface imperfections. By this painstaking process we end up with Stainless bars that, lot after lot, assure economical, trouble-free forgings.

You'll find your nearby Carpenter representative extremely helpful when it comes to finding ways and means of applying Stainless to your postwar products. Back of him stands a company with years of practical experience in solving Stainless problems. Call him in today or write us at the mill ... And for your copy of our 98-page book "Working Data for Carpenter Stainless Steels" drop us a note on your company letterhead, indicating your title.



LONGER LIFE. In spite of tremendous pressures and highly abrasive conditions in service—forged knuckle pins like this stay on the job longer because they are made from Carpenter Stainless. And note in the diagram that forging produced an even grain flow throughout, thus strengthening the thin sections at points AA and BB.

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Summary of GM Earnings Over 10-Year Period

General Motors Corp. has supplied the following information concerning the amount of business transacted and the profits earned by the Corporation during the years from 1935 to 1944, inclusive.

In the seven prewar years 1935-41 GM net income averaged \$184 million, but in the three war years 1942-44 net income averaged \$161 million. In other words, actual profits in dollars averaged \$23 million less during the war than before. Stated another way, profits on the average were 14 per cent higher before the war than during the war.

Yearly sales through 1935-41 averaged \$1,554 million compared with a yearly average of \$3,436 million through 1942-44. During the war GM sales more than doubled, but profits dropped 12 per cent, amounting to but 4.7 cents of each sales dollar.

During the war GM earned 4.7 per cent less on its invested capital than before the war and stockholders averaged 26 per cent less in dividends received.

Following are the figures for the 10-year period 1935-44:

Year	Net Sales (000 omitted)	Net Income (000 omitted)
1935	\$1,155,641	\$167,226
1936	1,439,289	238,482
1937	1,606,789	196,436
1938	1,066,973	102,190
1939	1,376,828	183,290
1940	1,794,936	195,621
1941	2,436,800	201,652
1942	2,250,548	163,651
1943	3,796,115	149,780
1944	4,262,249	170,995

Year	Dividends Paid On Common and Preferred (000 omitted)	On Common (000 omitted)
1935	\$ 96,476	\$105,654
1936	192,903	202,081
1937	160,549	169,728
1938	64,386	73,564
1939	150,319	160,262
1940	161,864	171,043
1941	162,608	171,786
1942	86,992	96,170
1943	87,106	96,284
1944	132,063	141,241

In the five years 1940-44 General Motors paid out \$4,723 million in wages and salaries or seven times its aggregate dividend payments of \$676 million. In 1944 total payrolls were \$1,380 million or almost ten times dividends.

Air Transport Problems Discussed at Meeting

Problems and developments in Air Transport were discussed when leading aeronautical engineers and specialists met at the Third National Air Transport Meeting in Washington. The Institute of the Aeronautical Sciences, sponsor of the meeting, arranged the program in which leading authorities read technical papers of primary importance in the air transport field.

Developments in flight instruments

for military airplanes are now available for commercial use, according to Orland E. Esval, of Sperry Gyroscope Co., Inc. The trend toward electrification of instruments and controls promises the advantages of better accuracy, high altitude and low pressure operation, dust-proof construction and easier installation.

Frank N. Piasecki, president, P-V Engineering Forum, Inc., offered the helicopter as a supplement to present and future air transport operations. In his paper "Economic Aspects of the Helicopter in Transport Operation" Mr. Piasecki pointed out that the need for this supplement lies in the high cost involved in the conventional airplane's inherent requirement of ground maneuvering on large flat fields far from the centers of population. He cited the lower operational costs of the helicopter in short-haul transportation, particularly from airport to city.

"Problems in Transatlantic Air Transport" was the subject of a paper presented by Captain W. M. Masland, of Pan American Airways System, in which were discussed possible solutions of problems concerning allowable cabin load and various elements of weather. These difficulties, said Captain Masland, must be overcome before transatlantic commercial flights may operate on highly regular schedules.

Revision of airlines' organization charts and the streamlining of operations are advocated by Harry S. Pack, vice-president of P-V Engineering Forum, Inc. In his discussion of possible improvements in operating efficiency, Mr. Pack cited the "underplanning" and "penny-wise, pound-foolish" philosophy as impediments to operating progress. Also emphasized was the tendency of engineering departments to be progressive in thinking but weak on taking action on new developments. Mr. Pack recommended possibilities for improving operations both in flight and on the ground, ac-

(Turn to page 110, please)

Willys Distributorships

More than 90 per cent of the total distributorships to be let by Willys-Overland Motors for the domestic marketing of the company's postwar line of passenger and commercial motor vehicles are now assigned, it was revealed by Geo. Harold Bell, director of sales.

All distributor and dealer outlets will be equipped with showroom facilities of the finest type, with special emphasis on parts and service, and will handle every unit on the company's manufacturing schedule, including "Jeeps," trucks and passenger cars, the Willys executive states. Many of these sales outlets will be housed in new quarters especially built for the Willys-Overland account.

CALENDAR

Conventions and Meetings

SAE Fuels and Lubricants Meeting, Tulsa, Okla., Lubricants Meeting	Nov. 6-7
Assoc. of American Battery Manufacturers, Chicago, Ill. Annual Meeting	Nov. 8-9
American Association of Motor Vehicle Administrators, Chicago	Nov. 13-16
National Metal Trades Assoc., Cleveland, Ohio, Annual Convention	Nov. 16-17
American Society of Mechanical Engineers, New York City, N. Y., Annual Meeting	Nov. 26-30
SAE Natl. Air Transport Engineering Meeting, Chicago, Ill.	Dec. 3-5
Natl. Assoc. of Manufacturers, New York City; Golden Anniversary Congress	Dec. 5-7
SAE Annual Meeting and Engineering Display, New York, N. Y.	Jan. 7-11
Miami All American Air Maneuvers, Miami, Fla.	Jan. 4-6
SAE Natl. Aeronautic Meeting, New York, N. Y.	April 3-5
Natl. Assoc. of Corrosion Engineers, Kansas City, Mo., Annual Meeting and Convention	May 7-9
National Aviation Clinic, Oklahoma City, Okla., 1945 National Clinic	Nov. 19-21

Marmon-Herrington Deliv-All

This new house-to-house delivery vehicle has just been announced by the Marmon-Herrington Co., Indianapolis, Ind. Its power is transmitted through a front driving axle of the company's own design. Rear wheels are mounted on independently sprung suspensions. The 3½ in. by 4½ in., four cyl. L-head engine develops 60 hp. The power unit may be disconnected from the body, and a service unit installed very easily, as all operating parts are integral with the power unit. A special self-sealing brake connection avoids the necessity of bleeding brakes after replacing or exchanging a unit.

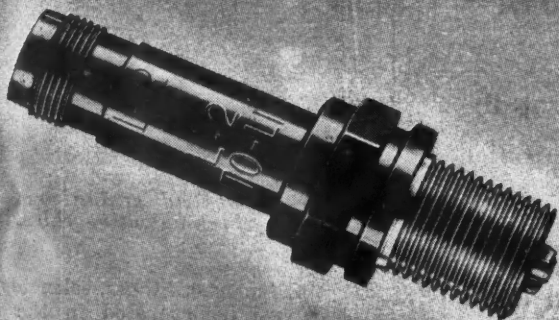
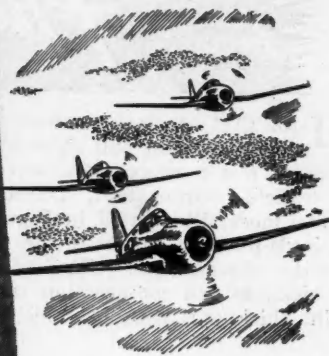


Auto-Lite

EQUIPMENT FOR AIRCRAFT

Wherever Allied fighting planes are flying you'll find electrical equipment precision-built by Auto-Lite. Its quality proved in the tough test of combat — equipment resulting from long years of careful development and research. Pictured here are a few examples of such equipment.

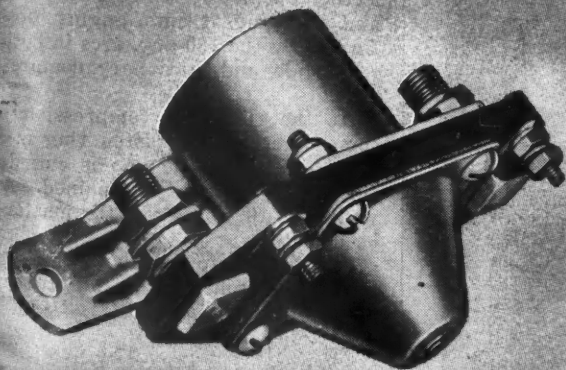
THE ELECTRIC AUTO-LITE COMPANY
SARNIA, ONTARIO
TOLEDO, 1, OHIO



These great spark plugs feature (1) Direct contact non-inductive resistor located in coolest position in plug; (2) Deep drawn nickel alloy center electrode tip; (3) Improved copper cooled center electrode; (4) High Dielectric strength and superior mechanical properties of "Corundum," Auto-Lite's insulator material.



Auto-Lite batteries are available in both 12 volt and 24 volt types. All are equipped with special non-spill vent plugs and assembled in either hard rubber or radio-shielded aluminum containers. The heavy duty battery has a capacity of 105 A.H. at 5 hr. rate; others have capacity of 34 A.H. at the 5 hr. rate.



Auto-Lite relays are available for both continuous and intermittent duty. They more than meet the most exacting Government requirements, giving dependable operation under extreme conditions of vibration, acceleration and altitude. Both types available are operative from minus 60 degrees F. to 160 degrees F.



The 5 mm. high tension ignition cable (left) has stainless steel conductor, rubber insulation, glass braid, neoprene sheath. Vega Chromoxide magnet wire (center) has heat resistant, space-saving qualities. Formvar magnet wire (right) has a special enamel with abrasive resistance 3 times that of conventional enamel wire.

AUTO-LITE

TUNE IN THE AUTO-LITE RADIO SHOW STARRING DICK HAYMES — SATURDAYS 8.00 P. M. — E. T. ON C B S

November 1, 1945

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New Production Equipment

THE first gaging machine ever developed for the full automatic checking of piston rings is announced by the Sheffield Corporation, Dayton, Ohio. The model illustrated in Figure 1 is a single-purpose machine for automatically checking oil rings of .108 in. thickness and compression rings of $\frac{1}{8}$ in. thickness, both of which have an

outside diameter of 5.750 in. The gap in both rings is .070 in. wide, with a tolerance of plus and minus .035 in.

The compression ring is tapered, while the oil ring has a profiled periphery. The machine will check an average of 1500 of these rings per hour and can be adapted to other sizes and types of piston rings by changing various

elements of the tooling.

The machine segregates the piston rings into three groups—(1) acceptable periphery and gap, (2) reject gap, and (3) reject periphery, because of failure to meet requirements. The entire checking and separating operation is done automatically, the operator having but to load the rings into the feeding device. Electronic circuits, photo-elec-



Teamwork—
complete
synchronization—
all members of a
smoothly
functioning
production team.



WYMAN-GORDON

Forgings of Aluminum, Magnesium, Steel
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DETROIT, MICHIGAN



Fig. 1. Sheffield gaging machine for checking piston rings.

tric cells, micro-switches, solenoids, and relays are incorporated in the automatic cycle to actuate the gaging and selector devices.

The top of the machine has been removed in Figure 2 to permit a close-up view of the feed device and other mechanism. The automatic cycle starts with the feed slide moving to the rear, selecting the bottom ring from the stack and carrying it into gaging position formed by the 180-deg. arcs in both the feed slide and stationary compression plate.

As the slide and compression plate come together, the piston ring is compressed so that the gap is closed and the width of gap is determined. A deviation of .001 in. from the master can be detected.

The vertical feed spider then descends onto the piston ring, pushing it into

(Turn to page 54, please)

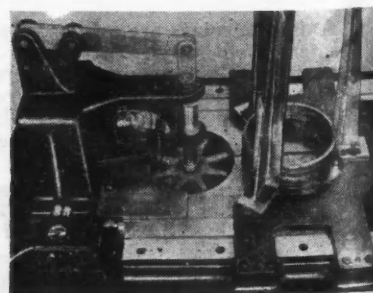
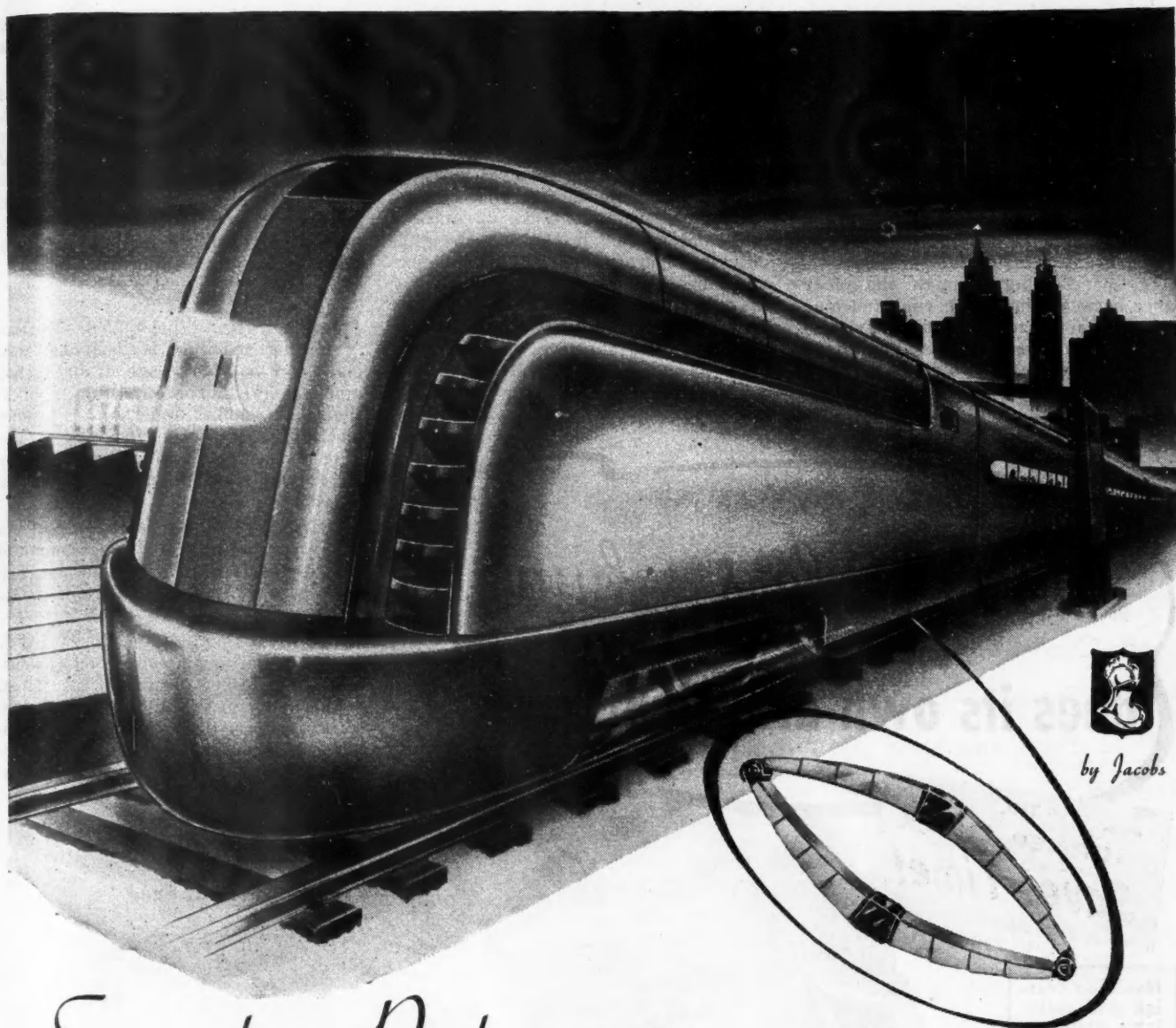


Fig. 2. Sheffield gaging machine with cover removed.



Smoother Performance Lower Maintenance Costs...

While conducting research for improvement of riding quality of railway cars, engineers introduced the application of automobile type steel spring-covers for protection of the leaf springs used on most of the existing railway passenger car and locomotive trucks.

Road tests proved that elliptical leaf springs, when equipped with Ajax Steel Spring-Covers by Jacobs, provided consistently bet-

ter riding performance and longer spring life.

The Spring-Covers keep dirt and water out and retain the lubricant which protects the springs from wear and stress.

Ajax Steel Spring-Covers, as well as other accessories for railway passenger trucks, designed to radically improve passenger comfort, are marketed as a unit by E. A. LUNDY, INC., 420 Lexington Avenue, New York, New York.

F. L. JACOBS CO. 1043 SPRUCE ST., DETROIT 1, MICHIGAN

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November 1, 1945

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constantly rotating master ring. Rollers on the ends of the spider fingers assist in properly positioning the piston ring opened to its normal operating position. A concentrated beam of light projected through an optical system scans the outside periphery of the piston ring where it is in contact with the master ring while it makes slightly more than a complete revolution.

If the ring is not sufficiently light-tight at any point on the periphery, the light penetrating through the clearance between the piston ring and master ring energizes a photo-electric cell which in turn sets up a holding circuit by means of a relay. This relay is not

energized if the piston ring is acceptably light-tight and the check is accurate to within .0001 in., i.e., a clearance of .002 in. will be accepted, while that of .0003 in. will cause the ring to be rejected. The device can be set for whatever tolerance is desired.

The inspected ring revolves with the master ring while the feed slide returns to original position, picks up another ring and carries it through the gap-checking operation. Then, as this second ring is injected into the revolving master ring, the previously inspected ring is ejected onto two solenoid operated selector shutters, or trap doors.

If the ring is acceptable, both shut-

ters remain closed, and the ring slides on through and out the front of the machine onto a rack.

If the ring is a reject because of either periphery or gap, selector shutters permit the ring to fall by gravity into the reject stations on the sides of the machine. A spring-loaded clutch throws the driving mechanism out of gear should the machine jam due to piston rings being laced together while loading into the feeding mechanism.

THE new No. 2 heavy Van Norman milling machine is designed especially for a wide range of production and general purpose milling applications. Its column and base are heavier and larger with scientific internal ribbing to assure rigidity for the heavy duty spindle and spindle transmission as well as the knee.

A feature included in the design is a heavy, large-diameter flywheel mounted on the inside of the column assuring smooth, uniform application of power to the cutter.

The cutter spindle is large in diameter and is mounted on double-opposed Timken bearings at front, double Timken in center and straight roller in rear. The new spindle transmission incorporates wide face hardened alloy steel gears mounted on

(Turn to page 56, please)

Hydraulic Press with Continuous Dial Feed



A "Hy-Mac" hydraulic press with continuous dial feed and automatic ejection of the work has been brought out by the Hydraulic Machinery Inc., Dearborn, Mich. As illustrated, the fixture has one station for manual loading, then goes through its cycle automatically and ejects the work. The cycle is hydraulic, the press being powered by a Hy-Mac hydraulic power unit.

New Keyless Chuck does its own drill tightening

THE
TURNER CHUCK
Saves Time!

Hardened bearing steel roller jaws grip the drill without chewing or scoring.

Grip is automatically and progressively strengthened with increased load pressure

Ball bearings increase life.

Absolutely KEYLESS. No more chewed drill shanks. No more time wasted looking for keys.

The Turner Chuck is self-energizing. Tightens itself by the action of the drill.

Drill will not slip in use. Chuck is automatically self-centering and drill runs true without hand adjustments.

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216 Randolph St.
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TURNER GRINDING COMPANY
HILTON, DRAYTON & CORTEZ • FERDALE 20, MICHIGAN

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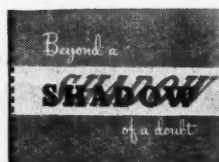
15 minutes...

AS COMPARED WITH $\frac{1}{2}$ a day!



Photo courtesy of United Precision Products Company, Chicago, Illinois

Precision gages and pins are checked for "utmost accuracy" on a Jones & Lamson Pedestal Optical Comparator and Measuring Machine in less than one tenth of the time it formerly took to inspect them without a Comparator. They are inspected for Length, Depth, Outline, Angles, Straightness and Grooves. This Optical Comparator is also used for inspecting Form Tools, Threads and other Profiles.



Perhaps a Jones & Lamson Optical Comparator could effect comparable savings for you. Write for our book, "Beyond a Shadow of a Doubt." Or, better still, ask for one of our inspection engineers to call and discuss your inspection problems.

JONES & LAMSON

MACHINE COMPANY

Springfield, Vermont, U.S.A.



Manufacturer of: Universal Turret Lathes • Pay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

DID YOU KNOW...

THAT JONES & LAMSON OPTICAL COMPARATORS ARE USED TO INSPECT KNITTING NEEDLES AND SINKERS USED FOR KNITTING RAYON FABRICS





LOOKING AHEAD!

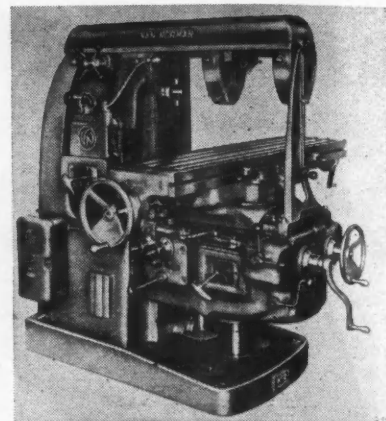
OUT OF WAR-PRODUCTION experience have come new production and control ideas. Many of them are readily adaptable to peace-production problems.

A GREAT MANY of these new developments in the general fields of weighing, testing, force-measuring, balancing, counting and batch-control can be seen in their war-applications, in the new booklet "Background for Victory".

THIS IS NOT A POSTWAR CATALOG. It is an idea book for idea men looking for new ways to get better and faster results in these fields.

A COPY WILL BE SENT to any industrial executive, without charge, and without sales solicitation of any kind.

Toledo Scale Company, Toledo 12, Ohio.



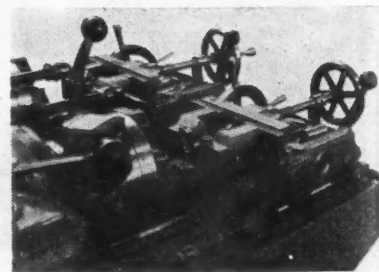
No. 2 heavy Van Norman milling machine.

multi-splined shafts rotating on taper roller bearings.

Front and rear directional control of all power feeds, actuated in the direction of desired movement, permit operation of the miller from front or rear position. Manual hand feeds are provided in both front and rear of the miller. Exclusive Van Norman single lever speed and feed selectors provide quick selection of 18 speeds and 18 feeds.

LANDIS MACHINE CO., of Waynesboro, Pa., has recently developed a special work-holding fixture for use with the Landmaco threading machine to thread hypoid driving gears and maintain the close tolerances or concentricity between the gear and the threads.

The special work holding fixture comprises a traveling center, located within the bore of the head and machine spindle, combined with a splined bushing to drive the work piece, and a manually operated work center on the machine



Landis work-holding fixture

carriage combined with a cradle type support to locate the work piece for easy alignment with the work center.

In threading hypoid driving gears, the tolerances which are set up require a high degree of concentricity between the thread, shaft and gear. The part presents no satisfactory driving means other than the splined end of the shaft and, therefore, the drive is located within the bore of the die head.

In operation, the work is placed on
(Turn to page 58, please)

Gas Tank Doors or Hollywood Wigs . . . **THIS TAPE DOES A BETTER JOB!**

Last month, we told you how a large Detroit industrial plant saved 64% in cost of tape for protecting gas tank doors. This month, the scene shifts to Hollywood — where a famous designer of fine hair pieces for stage and screen faced the sticky problem of holding together the interior portions of the delicate headpieces.

TAPE DID THE TRICK

Bauer & Black's experience came to his aid with a very thin, highly adhesive, pressure sensitive tape which bound the fine hairs to buckram neatly and efficiently. The tape also gave the right degree of reinforcement at the edge of the headband.

Results: After a final spraying with fine lacquer, the result was a much cleaner, neater product than had formerly been produced with messy liquid adhesives. The cost was negligible — the labor saved considerable.

OUR EXPERIENCE COVERS YOUR PROBLEM, TOO

Bauer & Black experience will help iron out your adhesive problems, too . . . point out where you can save money while doing a better job!

Can you really afford not to re-check your tape applications with technicians who make tape their business? Our men are available for consultation with you and your engineers — and

THIS SERVICE IS ENTIRELY FREE!

WRITE TODAY TO DEPT. 311 and tell us you are ready to avail yourself of the Bauer & Black FREE Economy Service. It's producing results for countless other enterprises . . . why not for yours?

A product of

BAUER & BLACK

Division of The Kendall Company

2500 SOUTH DEARBORN ST., CHICAGO 16, ILLINOIS



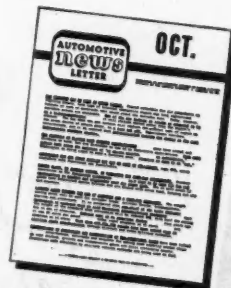
BAUER & BLACK

Industrial Tape

PRESSURE SENSITIVE ADHESIVE

HERE ARE THE FACTS . . . in the monthly AUTOMOTIVE NEWS LETTER

Keep informed on late developments in the industry with this timesaving digest of interesting and up-to-the-minute news and forecasts! Developments, trends and ideas offered in condensed form for your convenience each month. Ask for it. There is no cost — no obligation.



RESEARCH TO SPEED AND
IMPROVE METHODS . . .
PRODUCTION SHORT CUTS
TO REDUCE COSTS

★ ★ ★

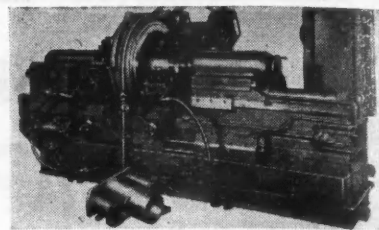
the supporting bracket and the work piece advanced with the carriage operating hand wheel until the splined end of the shaft engages the splined sliding bushing and center within the bore of the head. A hand wheel is then employed to advance the rear center to engage the gear end of the work. The complete chucking operation can be accomplished in only a few moments' time.

The work supporting bracket, or cradle, is detachable from the machine carriage front and can be interchanged with other similar brackets which may be designed to accommodate any other odd shape of work piece.

SNYDER TOOL AND ENGINEERING CO., Detroit, Mich., has designed and built four center-driven lathes to combine maximum production with minimum handling in processing large, heavy parts.

The machine illustrated is for processing fabricated steel axle shaft housings for trucks. The center drive unit is small with short rear center movement actuated by air cylinders. Tail stock housing is rigidly mounted. The lathe is used for turning various diameters near the wheel ends of the housing and facing numerous shoulders and flanges.

The second lathe is basically the



Snyder center-driven lathe.

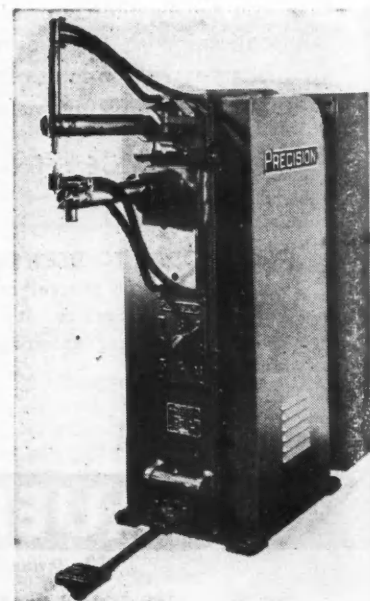
same as this machine, but built to handle heavier cast parts. Operations: turning with front tool blocks, facing and shouldering with rear tool blocks—which are reversible for rough or finish facing. Tail stop assembly slides in and out of work as an assembly.

The third lathe is essentially the same as the first two machines, but is built to handle a cast armor plate rotor and designed with considerable travel of the tail stock to provide loading space. Operations are turning and facing from both ends.

The fourth machine is for processing cast armor plate recoil housings. Rear tool slides have extremely long travel and conventional head stock and motor drive to center drive have been eliminated. Center drive is direct from motor and transmission in rear of machine. Operations: turning with front tool blocks and facing and shouldering with rear tool blocks.

PRECISION WELDER AND MACHINE CO., Cincinnati, Ohio, is introducing a rocker arm, foot-operated spot welder that is said to overcome the major objection to foot operation—lack of pressure—by a mechanism combining high pressure with minimum operator fatigue.

Among the features of the new welder are: welding pressures up to 400 (Turn to page 60, please)



Precision foot-operated spot welder

VORTEX
AIR CLEANERS

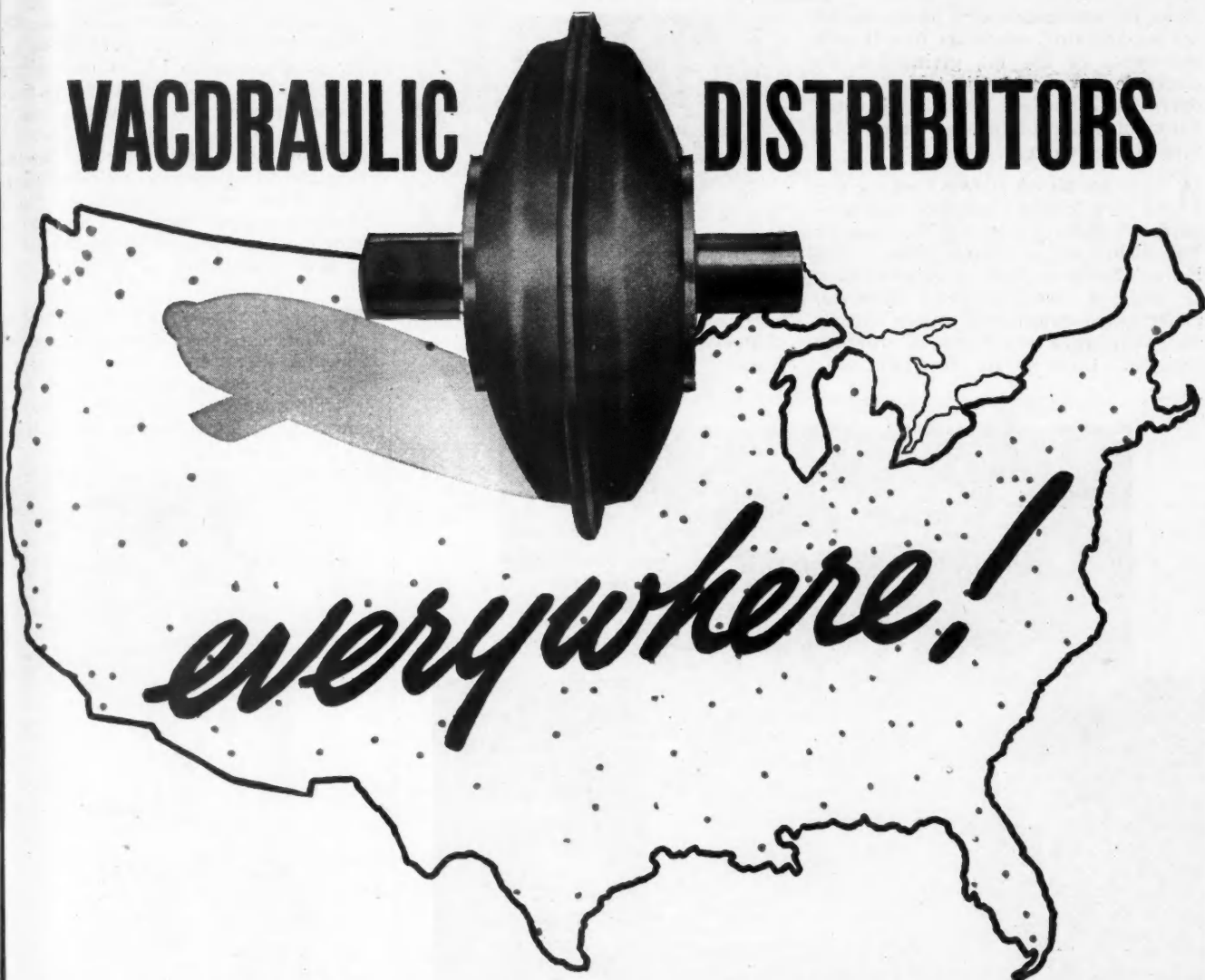
Thousands of these tiny coiled springs - interlocked and compressed into a mass of uniform density - form the filter element of VORTEX Air Cleaners.

- (1) The uniform, evenly distributed filaments provide the most effective cleaning for the space occupied.
- (2) The structural strength and permanent resilience of coiled springs withstand packing due to vibration and pulsation.
- (3) Only the specially designed and patented VORTEX machinery makes possible the economical production of these superior coiled spring filter elements.

*Write for
Bulletins
F-1295 and
F-1297*

VORTEX COMPANY, CLAREMONT, CALIFORNIA

VACDRAULIC DISTRIBUTORS



Vacdraulic recognition is not happenstance. It has been achieved only for four basic reasons.

Vacdraulic Feather-Touch Stopability imparts safe, split-second brake action to any good hydraulic system.

Vacdraulic controlled power has been proven in service.

There is no action lag—no rods or links to get out of adjustment.

Vacdraulic, smooth, safe brake action reduces maintenance costs.

Consider, for example, these important features of one of the three Vacdraulic Models No. 240 for vehicles with 1½" and 1¼" master cylinders.

1. Stainless steel ball valves with full hard Navy brass seats for long life and positive action.
2. Heavily chrome plated and polished control piston and full hard Navy brass piston rings for wear-free operation.
3. One piece aluminum diaphragm plate for rigidity and lightness.
4. Type E Neophrene diaphragm, not easily damaged by gasoline or other petroleum base fluids.
5. New design cylinders to facilitate installation and bleeding.
6. Low pressure cut-in for efficient trailer relay valve operation.

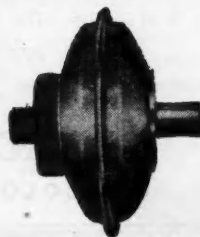
VACDRAULIC

KELSEY - HAYES WHEEL CO., DETROIT 32, MICH.

Sold to Automotive Distributors by

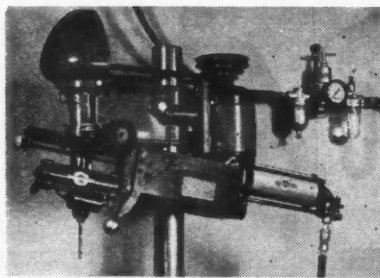
EMPIRE ELECTRIC BRAKE CO., Newark 7, N. J.

VACDRAULIC is a Trade Mark of Empire Electric Brake Company



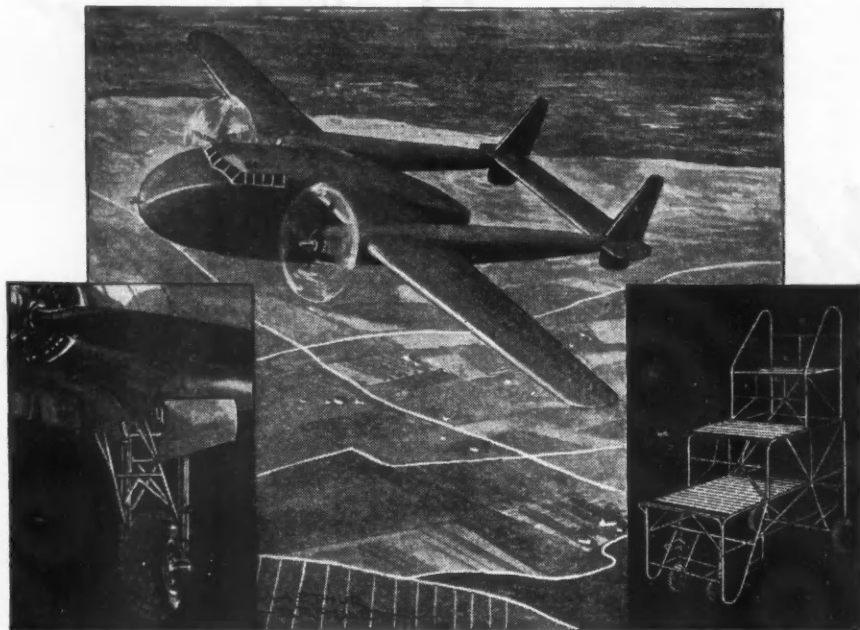
lb on the electrodes with 50 lb exerted by the operator, minimum foot treadle movement of 2½ in., giving 1¼ in. electrode movement, adjustable for best operating conditions, and micro-switch firing of timer to insure pressure before flow of current.

A STEPLESS-RANGE power feed for use on drill presses, milling machines, surface grinders, etc., is being made by The Bellows Co., Akron, Ohio. The Bellows-Senacon Feed advances work or tools a pre-determined distance, under a pre-determined power thrust, and automatically returns to starting position. Controls for feed and tra-



Bellows-Senacon feed

verse rate, for power thrust, and length of stroke are said to be simple and positive.



TO SPEED CARGO ABROAD

The giant of the skyways, the Fairchild designed C-82 Packet, is one of the top priority airplanes in production today. It carries a tremendous load in cargo or men and equipment on flights of 3,500 miles or more.

Aircraft Mechanics, Inc. is producing the Packet's vital nacelle support mounts.

The assignment to participate in the production of this urgently needed airplane honors us. Throughout the war period, we have produced high tensile steel forgings and welded tubular assemblies for the aircraft manufactured by more than fifty major aircraft producers. Our experience in forging and welded tubular assembly manufacture gives us the skill and ability to produce for the C-82, as scheduled.

We also are producing, on schedule, other valuable equipment necessary in the progress of the aircraft and its allied industries. Included are many items of Airport, Ramp and Hangar equipment such as passenger and cargo loading stands, nose and tail service units, battery, baggage and other supply type carts, refueling and service ladders, etc.

As we serve present customers, so can we serve you. For full information please write us, now.

BUY UNITED STATES WAR BONDS AND STAMPS



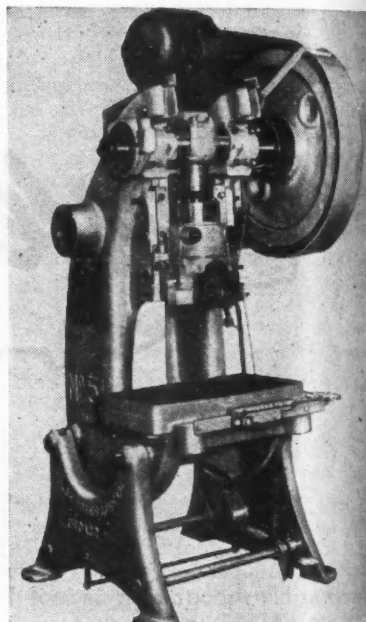
★ AIRCRAFT MECHANICS INC.

COLORADO SPRINGS, COLORADO

DESIGNERS ••• ENGINEERS ••• MANUFACTURERS

The new feed is powered by the Bellows air motor, and operates on any air pressure up to 160 lb, delivering a power thrust approximately five times operating air line pressure. Feeding rate can be adjusted to fit the needs of stock or tool. Adjustment of the two throttle valves permits unlimited variation of feed and retraction speed in a stepless range. Advance may be so slow it is barely discernible, the return as fast as desired.

WALSH PRESS AND DIE DIVISION of American Machine and Gage Co., Chicago, Ill., offers a complete new line of punch presses, ranging in size from 6 to 80 tons capacity. All sizes feature carefully ground forged steel crank

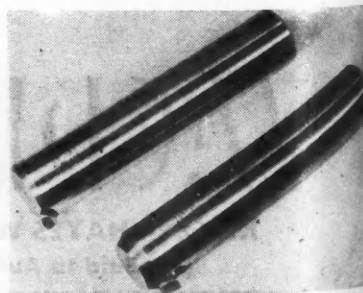


Walsh punch press

shafts, hand scraped bearings, solid web wheels and gears, ready inclinability, an adjustable die head, smooth, high speed operation, and a simple two button safety device for protection of operators.

TRI-BITS, the triangular shaped tool bit, manufactured by Weddell Tools, Inc., Rochester, N. Y., have now been applied to boring bars.

One or more Tri-Bits are fitted into triangular holes, tying the body to—
(Turn to page 64, please)



Tri-Bit boring bars.

THERE MUST BE NO COMPROMISE WITH

Safety

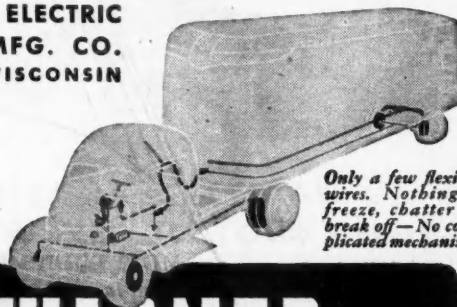
IN the months ahead, motor transportation faces a mighty task. Straining to meet unprecedented peacetime demands, American industries are in urgent need of equipment, machinery and supplies. Loads that fail to get through on time will not only upset production and sales programs for these industries — but mean losses in revenue to trailer operators. Delays due to accidents caused by ineffective brakes *must be prevented* — there should be no compromise with safety.

Protect your drivers, your cargoes, and your trailer outfits — give them the **EXTRA SAFETY** of *Controlled Braking Power* — exclusive feature of Warner Vari-Load **ELECTRIC** Brakes. No matter what the weather, the driver can pre-set any and all brakes to fit **BOTH** load conditions and road conditions — thus keeping his train straightened out and under full control even when the going

is slippery. Costly tie-ups due to damaged equipment are therefore avoided.

On all future trailer purchases, *specify* Warner Vari-Load *Electric* Brakes — world-famous for safety, simplicity and dependable, trouble-free performance.

**WARNER ELECTRIC
BRAKE MFG. CO.
BELOIT, WISCONSIN**



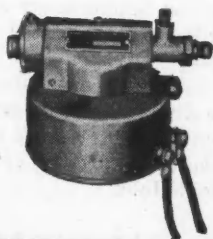
Only a few flexible wires. Nothing to freeze, chatter or break off—No complicated mechanisms.

WARNER

ELECTRIC BRAKES

NOW — Present Owners of Trailers with Warner Electric Brakes Can Have This New WARNER CONTROLLER

The new Warner Controller — simple and compact — synchronizes the hydraulic brakes on tractor with the Electric Brakes on trailer. The tractor's regular foot pedal operates both braking systems. This development creates smooth foot-touch tractor-trailer braking under all conditions — eases driving strain — assures greater safety. Controller is easily and quickly fitted into hydraulic brake line. See your Warner dealer about changing over your present equipment.



**FOOT PEDAL PRESSURE
CONTROLS BRAKES ON
BOTH TRACTOR AND
TRAILER**



Make the *CRITICAL ACCURACY* you build into your machines *EASY TO MAINTAIN*



MOST EQUIPMENT MAKERS who utilize Laminum in accurately fitting gear mesh and bearings do so primarily to reduce precision machining. But the same shim also assures accuracy of future service adjustments... too important to overlook. Bulletin on request.

Laminum shims are cut to your specifications, but for maintenance work, shim materials are sold through industrial distributors.

Laminated Shim Company, Incorporated
51 Union Street • Glenbrook, Conn.

LAMINUM

THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

2214

gether all around the blade. The triangular tool bit is locked into a vee by a single lock screw. The blade is further backed up and adjustable by a single adjusting screw back of the blade. The Tri-Bits, of high speed steel, cast alloys or carbide tipped, may be reground in an individual grinding holder and reset to size.

Boring bars are made standard, with plain, straight, or tapered shank. They are also made special with plain or strip pilots integral in the body or in combination with other tools as facing or chamfering heads or hollow mills.

Transient Recording Pickup Methods

(Continued from page 24)

This and similar oscillograms showed that during typical applications, ramming pressure builds up quickly to a value from 50 to 65 per cent of the final pressure. It shows that pressure at the brake builds up from zero over a comparatively long period of time. A third point is that the pedal feel of the conventional brake valve gives the pilot no indication of what is going on inside the brake system during the fill. He feels almost the full pedal reaction from the moment of depressing the pedal.

In a few hours, this recording technique supplied positive facts proving the futility of a seemingly obvious design change. Increasing the poppet diameter could increase the initial ram pressure only from 50 or 65 per cent of final pressure, toward 100 per cent as a limit. Since increasing poppet diameter causes other performance factors to deteriorate, the change was not considered worth an experimental model. Development effort was at once directed into more promising channels.

The later success of this effort is indicated in Fig. 13, an oscillogram showing ramming pressure more than 300 per cent of the final brake pressure, a much faster fill, and a pedal reaction which tells the pilot when pressure at the brake is rising into the effective range.

Bowser Acquires Kold-Hold

Bowser, Inc., Chicago, and Fort Wayne, Ind., has acquired the Industrial Temperature Cabinet equipment business of the Kold-Hold Co., Lansing, Mich. The low temperature equipment business will be consolidated with the Refrigeration Division of Bowser, which is located in Long Island, N. Y. This entire division will be moved to a new home in the near future and these units will be called by the trade name "Bowser-Kold-Hold."

PUBLICATIONS

The Silbraz Joint, a modern threadless connection, is described in a new booklet by Air Reduction Sales Co. It is a 16-page color booklet titled **How to Cash in on the Silver Ring**. Well illustrated, the booklet shows how Silbraz joints are made from patented bronze pipe fittings, valves and flanges—containing a factory inserted ring of silver brazing alloy in each port opening. Photographs and text show how the Silbraz Joints resist corrosion and vibration. Other sections describe the Airco-brazing Outfit for making these joints and many other uses for the outfit.*

Barnes Drill Co. has issued a 12-page **Condensed Catalog** of its complete line of metal working drilling and tapping machines, hydraulic drilling units, vertical and horizontal hydraulic honing machines and its magnetic-automatic coolant separators, the latter for application to any machines using liquid coolants.*

A new bulletin **Sundstrand Hydraulic Pumping Unit**, for both low pressure—large volume, high pressure—small volume, has been issued by Sundstrand Machine Tool Co. The bulletin contains illustrations, description of the operating principles, features of the unit, possible applications and engineering data.*

Felt Products Mfg. Co. has released a new 28-page **Quick-Reference Catalog No. 261**, designed to meet dealers' needs for an easier-to-read, better organized, streamlined catalog of gaskets and grease retainers for the popular makes of cars, trucks and engines.*

A new booklet, **Over 7,000 Ways to Control Dimensions**, has been released by Federal Products Corp. It is designed for desk or pocket use and contains 52 pages, listing many Dial Indicating Gages which meet practically every inspection need involving dimensional control.*

The Gear Grinding Machine Co. has issued two circulars on its products, 1) **Geargrind Universal Oscillating Grinder** which gives the features of the grinder, specifications and shows the various types of work performed by the grinder through a series of line drawings. 2) **Formsprag**, the full complement over-running clutch is illustrated and described.*

Aero-Seal Rubber Products has issued a booklet, **Mechanical Molded Parts of Synthetic Rubber**, a 32-page primer style picture book, designed as a guide to show engineering departments the best way to go about developing and securing successful parts molded from synthetic rubber. It gives typical development procedures worked out during the war and lists the various laboratory controls used. It has several pages of pictures of typical parts to help outline the field of use to date.*

A new 24-page booklet released by the Machine Tool Div. of the DoALL Co. describes the new technique for cutting materials known as friction sawing. The booklet explains why friction sawing is possible; its advantages and its limitations. A job selector chart is included in the booklet which contains a ready reference for selecting the proper sawing factors in cutting SAE steel, stainless steel, etc. Photographs and charts are used to illustrate the cutting rates to be expected from friction sawing including radii cutting factors, tube sawing and finish.*

A new Trutractor booklet entitled **Clark Carloader Method** has been released by Clark Trutractor Div. and describes the basic principles of modern mechanized material handling.*

A new booklet entitled **Plastics Primer**—a brief, illustrated booklet about phenolic plastics, has been issued by Durez Plastics & Chemicals, Inc. An outstanding feature is the concise chart which points out the physical and chemical properties of a representative group of Durez phenolic mold-

ing materials. Also included are two pages devoted to uses of resins.*

Sponge Rubber Products Co. has issued a 4-page pamphlet describing the various forms in which sponge rubber, bonded fibre and other subdensity materials are manufactured. It illustrates many molded, die cut and fabricated shapes of flexible, elastic compressible products used for cushioning, shock absorption, vibration dampening, sealing, insulating, gasketing, etc.*

The improved Model 860-C internal gear finishing machine is illustrated and described in a new technical bulletin by Michigan Tool Co. Complete specifications of the machine, together with a list of special and standard items, are included in the bulletin.*

A 16-page booklet entitled **Achieve Maximum Efficiency in High Speed Production**

with **Standard Conveyors**, contains many interesting illustrations of Standard Equipment in steel mills, foundries, machine shops, airplane and electrical appliance manufacturing plants.*

Forgings for Aircraft is the name of a 20-page color booklet, published by The Steel Improvement & Forge Co. Various types of aircraft forgings are described and illustrated. The four general types of precision forgings suitable for aircraft parts are described.*

An illustrated booklet explaining the historical relation between jobs, machines and prices has been published by the National Machine Tool Builders' Assoc.*

* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE and AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.



BRAKE DRUMS



BRAKE SHOES

DEPENDABLE CASTINGS ENGINEERED TO YOUR NEEDS

In addition to making castings in ALL ferrous metals—gray iron, Gunite, malleable, and steel—we have an engineering and metallurgical staff thoroughly familiar with performance requirements. Our customers are invited to take advantage of our broad experience, based on 90 years in the foundry business, to help in selecting the correct material specifications for attaining better-than-expected results. We show here items of particular interest to automotive manufacturers—Cylinder Liners, Brake Shoes, and Brake Drums. Drums are completely finished in our own machine shop. *Let us quote on your requirements.*



GUNITE CASTINGS...FOR TRUCKS, TRACTORS, TRAILERS, and BUSES

PERSONALS

Recent Appointments Among Automotive and Aviation Manufacturers:

General Motors Corp., Colonel Frederick C. Horner, Director of Field Operations Section, Distribution Staff.

Chrysler Corp., Charles L. Jacobson, Asst. to the General Mgr. in charge of subsidiary operations.

Ford Motor Co., L. W. Smead, business management head for General Sales Division. Clyde R. Paton, consulting Engineer.

Reo Motors, Inc., Karl Probst, Chief Engineer.

Hudson Motor Car Co., Joseph W. Eskridge, General Supt. of Car Bldg., in

charge of all body building and car assembly.

White Motor Co., H. R. Stickel, head of national accounts. Lt. Col. G. Taylor Myers, Sales Mgr., Manhattan Branch.

The Studebaker Export Corp., C. Kirk Kiene, District Mgr. of India.

Nash Motors, Laurence L. Drader, export representative Middle and Near East.

Graham-Paige Motors, Maurice L. C. Rutledge, South American Regional Mgr.

Curtiss-Wright Corp., Raymond W. Young, Vice-Pres. in Charge of Engineering.

Republic Aviation Corp., H. H. Cartwright, Asst. to the President. Ken Ellington, Director of Public Relations.

Kellett Aircraft Corp., Leonard C. Peskin, Vice-Pres.—contracts.

The Bunting Brass & Bronze Co., Lt. Col. John S. Tawressey, Vice-Pres. in Chg. of Engineering.

Aircraft Screw Products Co., Inc., Otto Haas, Director of Research. I. P. Stafford, Sales Mgr., Distributor Div.

E. I. du Pont de Nemours & Co., Robert L. Richards, Mgr. of Nylon Div. Albert Kunsman succeeds Mr. Richards as Asst. Mgr. of Cellophane Div.

The Perfect Circle Co., J. W. Kern, Regional Mgr., Los Angeles, California.

Norton Co., C. Leonard Shaw, Publicity Mgr., Russel A. Reed and Robert P. Anderson, Asst. Publicity Mgrs.

L. R. Buckingdale, Vice-Pres. in Chg. of Engineering, The Timken-Detroit Axle Co., appointed Chairman of the SAE Technical Board.

The Lincoln Electric Co., H. F. Kneen, Vice-Pres. in Chg. of Manufacturing, and G. G. Landis, Vice-Pres. in Chg. of Engineering.

Bendix Aviation Corp., Bendix Products Div., R. C. Grimm, Field Representative for Service Sales Dept.

Allis-Chalmers Mfg. Co., Arthur R. Toft, Mgr. of Advertising and Public Relations Depts. R. N. Landreth, Asst. to the Vice-Pres., General Machinery Div.

Twin Disc Clutch Co., N. F. Adamson, Vice-Pres. in Chg. of Sales and Engineering.

Chicago Pneumatic Tool Co., Guy J. Coffey, Vice-Pres. in Chg. of Sales.

Precision Welder and Machine Co., William E. Klingeman, Chief Engineer.

United States Rubber Co., Lt. Col. Foster Stewart, in Charge of Distribution Planning for Tire Div.

Briggs Mfg. Co., W. Dean Robinson, Pres. and Gen. Mgr., E. E. Lundberg, Vice-Pres. and Asst. Gen. Mgr.

The Cummins Engine Co., Inc., Norman E. Palmer, General Sales Mgr.; J. D. Allen, Sales Mgr. of dealer organizations, and Fred W. Sparks, Sales Mgr. of manufacturing accounts.

Pennsylvania Salt Mfg. Co., additional appointments to Research and Development staff; Dr. E. B. Gunyou; Dr. Harry G. Walker; Dr. Thaddeus Parr and Mr. Murray Zakheim.

The Arco Company, J. J. McCormick, Mgr. of the Products Development Laboratory; Dr. Edward G. Bobalek, Mgr. of the Resin Research Dept.

Ace Mfg. Corp., Edward C. Hoefflich, Sales Mgr.

Ajax Electric Co., Inc., Edward Edmunds, Chief Metallurgist.

Metal Specialty Co., Harry M. Forman, Secretary and a member of the board of directors.

F. J. Stokes Machine Co., Dr. Earl W. Flisdorf, Director of Research and Development.

B. F. Goodrich Chemical Co., Wayne Brinkerhoff, Advertising Mgr.

Aireon Manufacturing Corp., A. E. Welch, Executive Vice-Pres. and Treasurer.

Philco Corp., Industrial Radio Div., R. J. White, Asst. Sales Mgr.

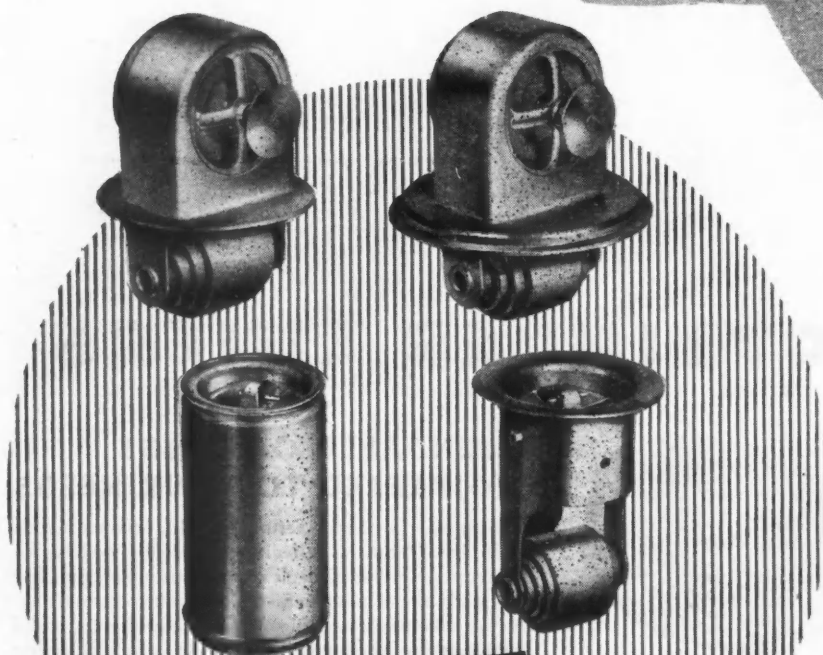
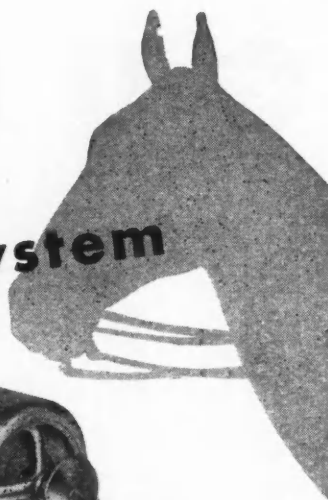
Rodgers Hydraulic Incorporated, Hugh Krampe, General Sales Mgr.

Tanner Chemical Co., James Berry, Vice-Pres. and Treasurer.

American Central Manufacturing Corp., Charles A. Reinhold, Jr., Sales Promotion Mgr.

Uncontrolled cooling results in excess sludge, crank case dilution, motor wear and waste of gas and oil. Control curbs all of these and gives a lift in performance. That's why automotive designers have made it standard practice to

Put a Bridle on the Cooling System



DOLE

Thermostats

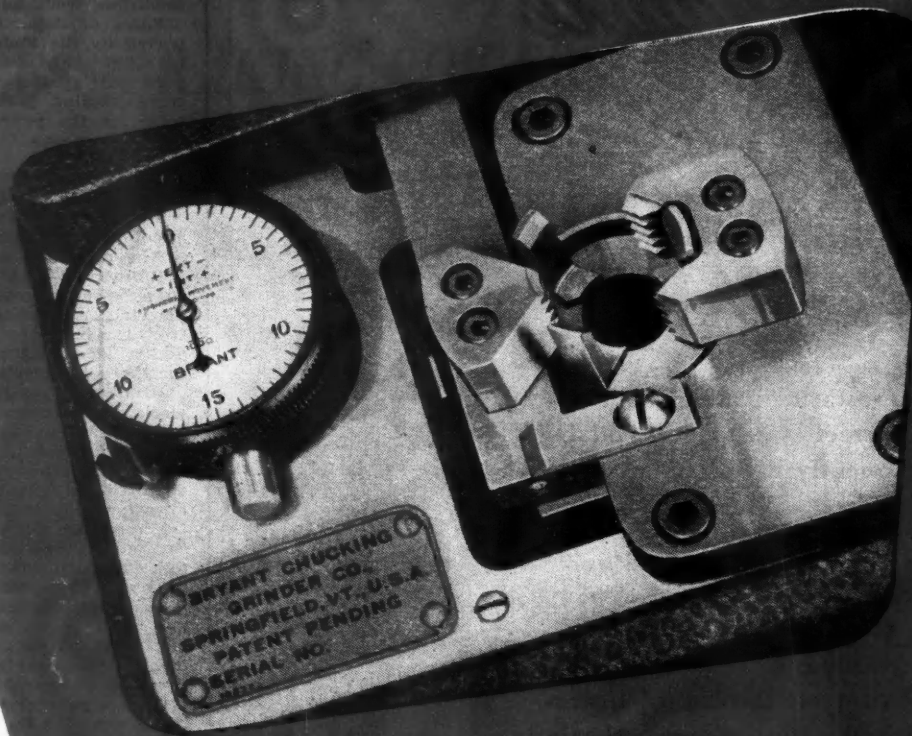
In a Range of Types for Every Car

THE DOLE VALVE COMPANY
1901-1941 Carroll Avenue, Chicago 12, Illinois
Los Angeles Detroit Philadelphia

Borg-Warner Division Changes Name

The corporate name of the Ingersoll Steel and Disc Div. of Borg-Warner Corp. has been changed to Ingersoll Steel Div., according to Roy C. Ingersoll, president. The change was made not only in the interest of brevity, he said, but also because a more general name is better adapted to the wide line of products which now are in production or in late stages of development.

How to speed thread inspection . . .



Bryant Thread Gages

☆ This new Bryant Thread Gage Catalog describes all the advantages of these unusual gages . . . it tells how you can inspect internally and externally threaded parts four or five times faster . . . it tells how threaded parts can be inspected all over in a matter of seconds . . . it describes and illustrates three standard and one special model for work from 3/8" to 8" internal and 3/16" to 8" external. A free copy is yours for the asking!

send the coupon →

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CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

**BRYANT CHUCKING GRINDER CO.
Springfield, Vermont, U. S. A.**

Please send me Catalog No. G3 which gives complete details on the Bryant Thread Gages

NAME _____ TITLE _____

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BIMETALS:

*Dependable
Operation*

UNDER DIFFICULT CONDITIONS

Modern thermostatic bimetals—of the nickel-chrome-steel type developed by Chace—are frequently called upon to do exacting jobs under extremes of heat and cold.

The bimetal element governing the safety pilot in a gas stove must operate perfectly in a flame temperature of 1200° F. The bimetal element of a meteorological instrument at high altitudes must operate perfectly at 100° F. below. In aviation instruments, the actuating element must respond instantly and unfailingly—whether the plane is climbing through swiftly changing temperatures, is flying upside down, or is shooting ahead at 400 miles an hour.

Whatever your temperature responsive device may be—and however difficult its operating conditions—you will find among Chace Thermostatic Bimetals one precisely suited to your needs.

There are 35 types, each of which offers specific advantages to appliance or control manufacturers. Sold in sheets, strips, and finished forms.

W.M. CHACE Co.

Manufacturers of
Thermostatic Bimetals and Special Alloys
1610 BEARD AVE • DETROIT 9, MICH.

Business in Brief

*Written by the Guaranty Trust Co.,
New York, Exclusively for AUTO-
MOTIVE AND AVIATION INDUSTRIES*

Further moderate recessions of general business activity have been indicated. The *New York Times* index for the week ended Oct. 6 stands at 116.7, as against 119.5 for the preceding week and 135.5 a year ago.

Sales of department stores, as reported by the Federal Reserve Board, for the week ended Oct. 6 were 11 per cent greater than those in the corresponding period last year. The total for the year to date also is 11 per cent above the comparable 1944 figure.

Electric power production during the first week of October was 7.9 per cent below that a year ago, as against a comparable decline of 7.5 per cent in the preceding week.

Railway freight loadings during the same period totaled 767,985 cars, showing a decline of 7.7 per cent from the figure for the preceding week and a level 12.4 per cent below that for the corresponding period last year.

Crude oil production in the first week of October averaged 3,620,850 barrels daily, as against 4,357,450 barrels a week earlier and 4,691,550 barrels a year ago. Reflecting unusual labor disturbance, this is the lowest weekly output in several years.

Bituminous coal and lignite production during the week ended Sept. 29 totaled 10,930,000 net tons, which is 670,000 tons below the output for the preceding week and 1,250,000 tons below that for the corresponding period last year. Total production in nine months this year is 7.2 per cent less than the comparable 1944 figure.

Civil engineering construction contracts awarded during the week ended Oct. 11 were sharply reduced, according to *Engineering News-Record*. The total of \$33,206,000 is 56 per cent below the figure for the preceding week and 42 per cent less than the corresponding amount last year. The total value of contracts recorded thus far in 1945 is 10 per cent above the comparable sum shown a year ago.

The wholesale price index of the Bureau of Labor Statistics for the week ended Oct. 6 registered a further advance to 105.2 per cent of the 1926 average, as against 105.0 a week earlier and 103.9 a year ago.

Member bank reserves increased \$117,000,000 during the week ended Oct. 10. Underlying changes reflected include an increase of \$102,000,000 in Reserve bank credit and a decrease of \$113,000,000 in Treasury deposits with Federal Reserve banks, accompanied by an increase of \$109,000,000 in money in circulation.

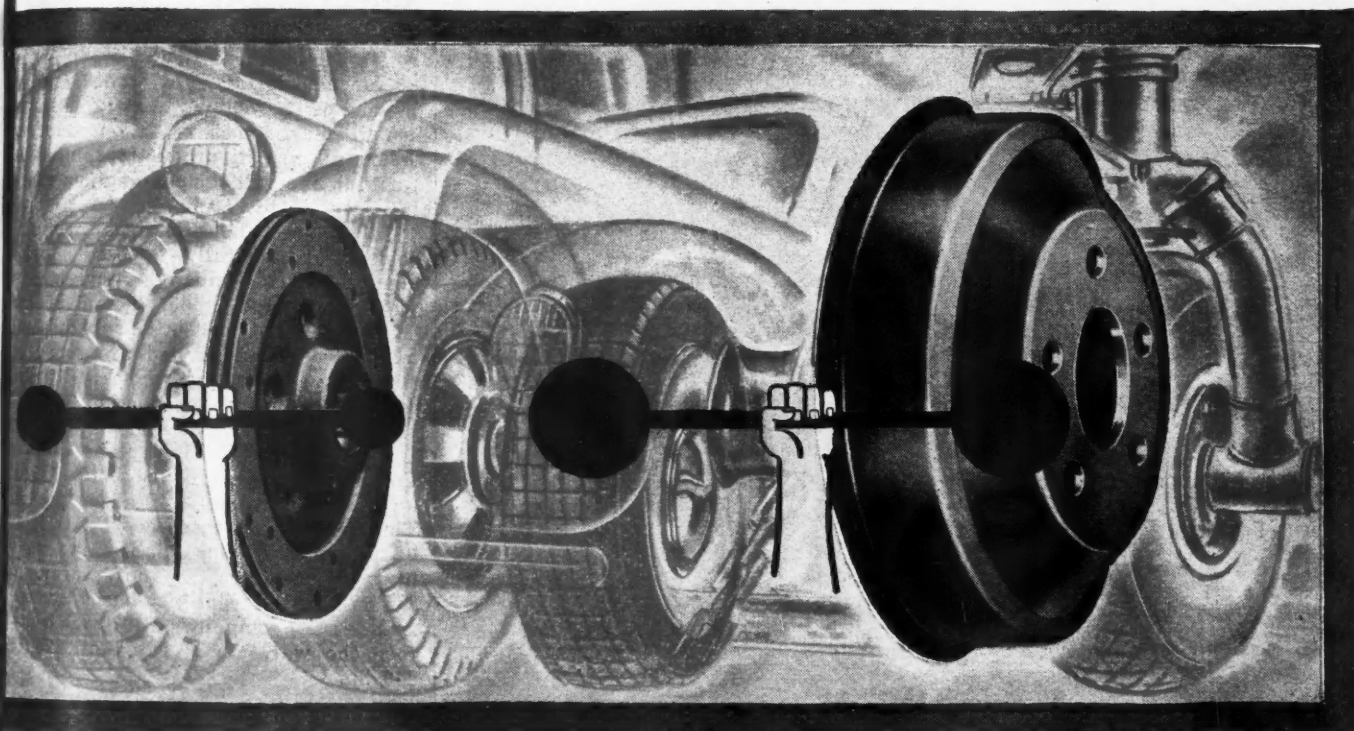
Loans and investments of reporting member banks during the same period declined \$147,000,000, notwithstanding a rise of \$53,000,000 in commercial, industrial and agricultural loans.

Crosley Assembly Plant

The Crosley automobile will be assembled at Marion, Ind., in a plant purchased from the old Peerless Co. of America, Inc., according to Powell Crosley, Jr., president of the newly formed Crosley Motors, Inc. Purchase price of the plant is reported to be \$350,000. Engines for the Crosley will be built in Cincinnati.

Elimination of **Brake Drums**

means **LESS ENGINE POWER NEEDED TO START!**
LESS BRAKING POWER NEEDED TO STOP!



Easier starting and stopping are two of the many advantages secured by the Lambert Disc Brake.

The elimination of the rotating brake drum required in the conventional internal expansion brake and the substitution of a rotating disc weighing up to 83% less means less inertia to over-

come in starting... less to overcome in stopping.

Other advantages resulting from the elimination of the brake drum include... **EASIER WHEEL BALANCING...** no brake drum scoring troubles... elimination of uneven tire wear resulting when brake drums wear out of true.

for

cars, trucks, buses, tractors, aircraft and industrial machinery

Lambert Disc Brakes



1042

Air • Hydraulic • Mechanical
Products of a Division of the Auto Specialties Mfg. Co.
St. Joseph, Michigan • Windsor, Ont., Canada

November 1, 1945

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

73

New Products for Aircraft

Goodrich Offers Line of Polyvinyl Chloride Products

A group of polyvinyl chloride products, with a great variety of aviation applications, has been added to the lines of the Aeronautical Sales Division of the B. F. Goodrich Co.

The plasticized polyvinyl chloride

resins can be applied to fabrics, metals, or stiff plastic board, all widely used in aeronautical applications. Special cements have been developed for attachment of the material to metals or woods.

Materials with which these products will compete are leather, rubber and linoleum. Advantages of the material

include weight savings and longer wear.

Made in any color, and embossed to meet specific requirements, the material is said to be unaffected by sunlight, acids, alkalies, petroleum fractions, body acids, ageing and salt water. Color is full depth of the material eliminating necessity of refinishing. Special production methods make it possible to create special finishes not found in most polyvinyl chloride products, including special pyramid designs.

Continental Announces New Aircraft Engines

Continental Motors Corp. is starting deliveries of three new 6-cyl aircraft engine models for light planes and by the end of the year will have four additional 6-cyl models in production. When all are in production the Continental line will include engines ranging from 65 to 210 hp.

All of the 6-cyl engines are air-cooled, horizontally-opposed units similar to the company's 4-cyl models which are rated at 65, 75 and 85 hp. The three 6-cyl models on which shipments have just started are rated at 100, 115, and 125 hp. The additional models to go into production will be rated at 150, 165, 185 and 210 hp.

In addition to its light plane engines Continental will produce both 7 and 9-cyl radial engines for larger planes. The 9-cyl engine, rated at 525 hp, is to be used in a medium weight plane made by a large aircraft manufacturer.

The 7-cyl engine is basically the same as the company's R-670 made before the war. It is rated at 220 to 240 hp.

Transmitter-Receiver Unit for Personal Planes

The Model ATR-3 transceiver for personal planes, made by Harvey-Wells Electronics, Inc., Southbridge, Mass., is a lightweight transmitter-receiver unit which serves as a means of radio communications from plane to ground and ground to plane, as a direction finder to insure navigational safety, and for broadcast entertainment.

(Turn to page 100, please)

Easily-Drained Bowl for Fuel Filters



A new aircraft part and accessory manufactured by Consolidair Inc., Alliance, Ohio, is an easily-drained fuel filter bowl which fits light planes. With this device it is not necessary to remove both cowl and bowl, for an adaptor extends from the base of the bowl to a safety type valve which is flush with the outside of the cowl.

Quiet



HOOVER

BALL AND BEARING COMPANY
ANN ARBOR, MICHIGAN

BALLS - BALL BEARINGS - ROLLER BEARINGS

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TRIES



WHY MONSIEUR DESCHAMPS NEVER OWNED A CAR

IT isn't that he never wanted one. A Frenchman of the upper middle class appreciates the good things of life. But the bitter truth is that French industry never produced a car that Monsieur Deschamps (or 85% of French families) could afford. Yet, the motor car was invented in his country.

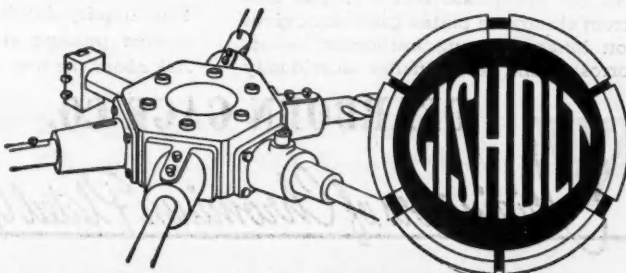
Yes, the first automobile rolled in Paris. But the first assembly lines rolled in Detroit! And they reached a peacetime tempo where "a car for every family" came nearer fact than fancy—where America's automotive industry was producing more cars in six months than existed in all of France.

Swift-moving assembly lines are only the symbol of mass production. Look behind them and see how they're fed. You'll find, for example, *mass machining*—the producing of as many as 3,600 machined parts in a single automobile. Multiply that by nearly 5,000,000 cars a year and you see the need for speed and accuracy to get costs down where the average family can own one.

In those long rows of machine tools you'll find many with the name "Gisholt." And you'll find Gisholt engineers, too, working hand in glove with manufacturers in the never-ending search for ways to do the job still better, at still lower cost. It's a constant challenge to do our part for an industry that creates employment for nearly 7 million people and contributes so much to the enjoyment of life in America.

GISHOLT MACHINE COMPANY

1205 East Washington Ave. • Madison 3, Wis.



Turret Lathes • Automatic Lathes • Balancing Machines • Special Machines

Wartime Airplane Speed Record Now Revealed

The veil of military secrecy has been lifted from another of the nation's wartime airplane accomplishments. Republic Aviation Corp. has just announced, with War Department authorization, that an experimental model of the P-47 Thunderbolt—known as the "J" type—was flown at a speed in excess of 500 mph on Aug. 4, 1944.

Powered by a Pratt & Whitney R-2800-C Double Wasp engine and driven by a Curtiss-Wright electric experimental propeller, with a special

two-inch hand-welded trailing edge, the record-smashing J-type Thunderbolt was the only one in its class to be built. But this experimental fighter is said to have paid for itself many times over through improvements incorporated into subsequent models of the more than 15,000 P-47's turned out by Republic for the Army Air Forces.

IAS Issues 1945 Catalog

The Institute of the Aeronautical Sciences has announced the release for distribution of the *Aeronautical Engineering Catalog, 1945 edition*.

Published as a reference guide for

aeronautical designers and engineers, this catalog contains specifications and engineering data on a wide variety of aircraft products available for postwar commercial and military airplanes. The only reference source of its kind, the catalog also lists in its more than 600 pages the sources of supply of over 2000 items manufactured by more than 1800 companies.

Larger and more complete than last year's, this edition offers technical information about aircraft products ranging from rivets to gas turbine jet engines, marking the first time aircraft jet engine copy has appeared in any general catalog.

Established in 1944 as an annual publication, the *Aeronautical Engineering Catalog* is an official publication of the Institute of the Aeronautical Sciences, the professional society for the aircraft industry. Welman A. Shrader is editor.

Johnson Appoints National Sales Representative

The Johnson Rubber Co., Middlefield, Ohio, has appointed the Johnson-Sperry Co., Middlefield, Ohio, as national sales representatives, handling the entire sales of both the parent company in Middlefield and the Pawling, N. Y., branch.

This new sales organization is headed up by Lugh M. Johnson, formerly vice-president and general manager of Johnson Rubber Company, and Pierce Sperry, formerly vice-president and sales manager, both having been connected with Johnson Rubber Co. for the past 20 years.

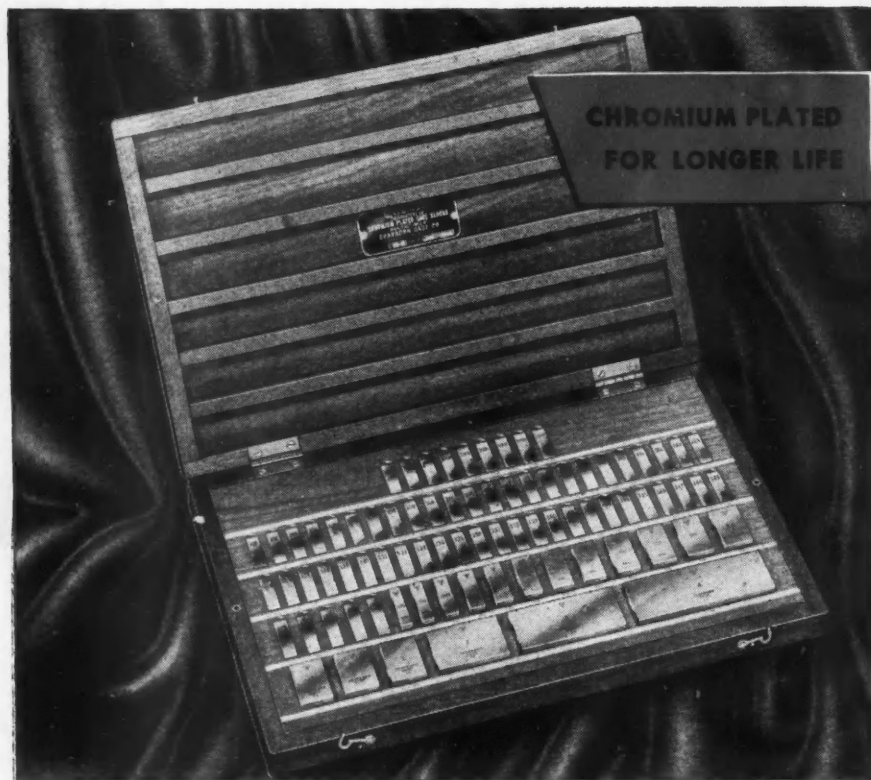
Skinner Appointed

Thomas W. Skinner has been appointed general manager of the Lincoln Division of the Ford Motor Co. Mr. Skinner, who has been assistant director of sales and advertising of the Ford Motor Company, under J. R. Davis, has been with Ford since his graduation from Harvard Business School in 1925. Frank J. Denney, who has been advertising manager for Lincoln and Mercury, will serve as sales manager in the new Lincoln organization.

Eventually all phases of Lincoln operations will be directed from the Lincoln plant at Warren and Livernois. In the past, the Lincoln plant has been devoted exclusively to manufacturing operations.

Rototiller Production Plans

The Farm Equipment Division of Graham-Paige Motors Corp. plans to produce a minimum of 50,000 Rototillers during the first full year of operation at Willow Run. The first of the machines, which prepare the ground for immediate planting in a single operation, will be ready for delivery early in December, according to Joseph W. Frazer, president.



ELLSTROM

offers IMMEDIATE DELIVERY

You can now place your order for the finest gage block that money can buy and get immediate delivery. The Ellstrom chromium plated gage block gives you longer wearing millionths, resists corrosion and rust. Offered individually

or in complete sets in a choice of three classes. Unconditionally guaranteed.

Your inquiry for details and prices will receive prompt attention. Write now. Ask about the new round gages.

DEARBORN GAGE CO. 22037 BEECH STREET DEARBORN, MICHIGAN



Originators of Chromium Plated Gage Blocks

Basic Two-Way Hydraulic Power For a Wide Range of Push-Button Control Applications

Hydro-Lift
BY MOTOR STATE



THE HYDRO-LIFT basic power unit, originated and developed by Motor State Products Company, provides a versatile source of hydraulic power for a wide range of push-button control applications. Originally developed as an operating unit for the raising and lowering of the convertible push-button top, Hydro-Lift power now finds an almost endless list of applications in the modern "automatic" motor car.

Because the Hydro-Lift power unit is double acting, furnishing positive two-way power, it can be utilized to accomplish the automatic movement of any desired unit in any direction.

The Hydro-Lift Cylinder and Actuator are so compact as to be readily built into existing designs, often with no change.

Through the medium of the Hydro-Lift Cylinder and the Hydro-Lift Actuator, the push-button will now operate completely automatically:

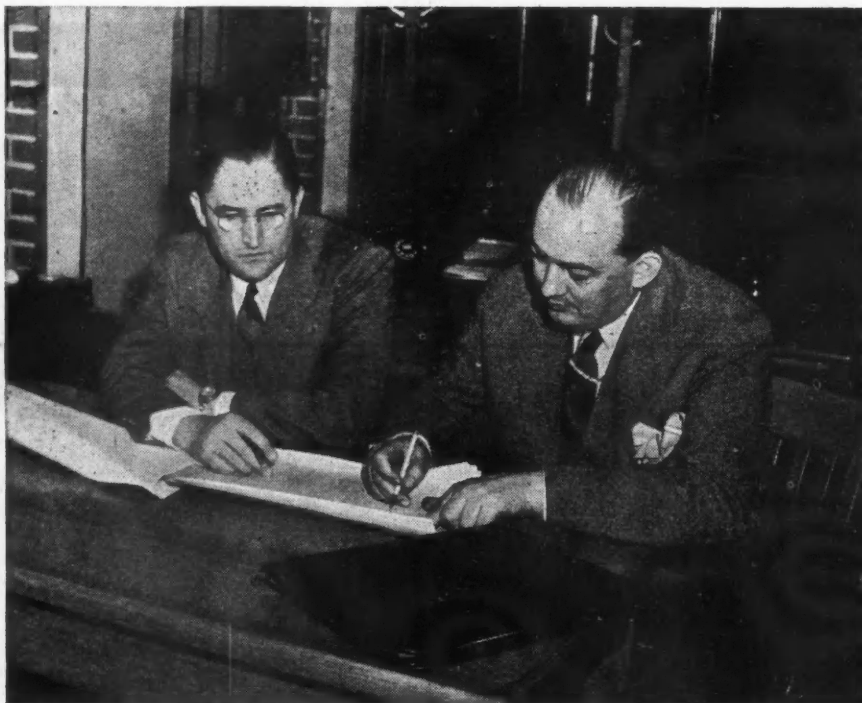
- All Door Windows
- Quarter Windows
- Rear Light—providing draftless ventilation
- Rear Deck Lid—making lock unnecessary
- Drivers' Seat Adjustment
- Motor Hood
- Folding Top—in case of convertibles

Motor State engineers will welcome an opportunity to co-operate with your engineering department in adapting Hydro-Lift power to your specifications.

MOTOR STATE PRODUCTS COMPANY

General Offices and Plant: Ypsilanti, Michigan • Detroit Office: 2-257 General Motors Building

ORIGINATORS OF THE AUTOMATIC PUSH-BUTTON TOP



RE-DESIGN NOW— for LIGHT WEIGHT... MACHINABILITY...



RESISTANCE TO CORROSION

In the keen postwar competition, no product can afford to carry the competitive disadvantage of extra poundage.

To gain such advantages as light weight, easy machinability, and resistance to corrosion, a recent survey covering 187 products showed that in 109 of them changes were contemplated from other metals to aluminum.

Let Acme's experienced engineering staff show you how Acme Aluminum Alloy Castings can improve your product, speed your production, and strengthen your competitive position.

Submit your blueprints or specifications for recommendations. Often a slight design modification suggested by Acme engineers reveals unsuspected possibilities for a change to aluminum castings, with its many advantages. And there's no obligation.

ACME ALUMINUM ALLOYS INC.

DAYTON 3, OHIO

Patterns • Tools • Aluminum, Brass, Bronze Castings • Engineering

New York: F. G. Duffen Co., 111 Broadway

Chicago: Metal Parts & Equipment Co., 2400 W. Madison St., St. Louis: Metal Parts & Equipment Co., 3615 Olive St.

Equipment Setup at Brad-Foote Works

(Continued from page 44)

production which might otherwise be interrupted if a given machine were busy on a long run and other work specified for the same machine would have to wait its turn. Instead, the foreman can route a new job over some other machine, not busy at the time.

Routing for Helical Gear R.H. 53T, 5 D.P.

OPERATION

Receiving inspection.
Rough turn complete (allow finish turn stock).
Heat treat 180-220 Brinell.
Check for hardness—Navy witness.
Face, bore, counter-bore and chamfer turn OD, turn web and face flange (allow grind stock bore, counter-bore and OD).
Opposite side—Finish turn OD web face flange, chamfer bore (allow grind stock).
Grind bore and counter-bore.
Surface grind opposite face.
Grind OD.
Semi-cut (53) teeth R. H.
Burr and wash.
Shave (53) teeth R. H.
Drill and ream (6) 15/32 holes.
Drill, tap and counter-sink (2) 3/16 NC-3 holes.
Drill, ream (2) .500-.5005 holes.
Burr, wash and stamp No. and timing marks.
Scratchbrush and polish.
Shipping inspection.
Navy inspection.

Routing for Steel Spur Gear 41T 3.6538 D.P.

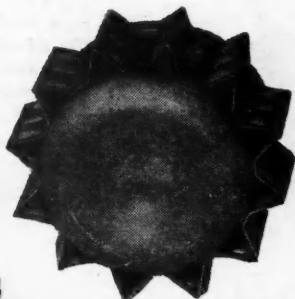
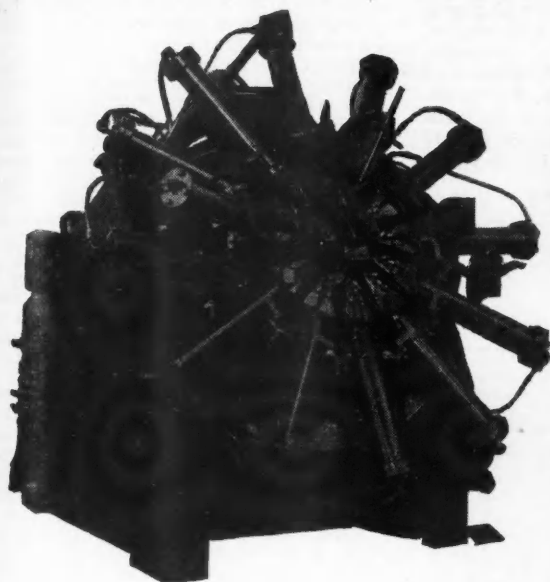
OPERATIONS

Receiving inspection.
Rough turn OD and hub, rough bore and rough face flange.
Drill (3) 1 1/2 inch holes on 6 1/4 inch B.C.
Normalize.
Re-bore, face flange, hub, chamfer, bore flush side (allow finish stock).
Opposite side—Face flange, turn hub, face and chamfer bore (allow finish stock).
Finish turn web both sides.
Rough and finish broach spline.
Face flange sides.
Semi-finish cut (41) teeth.
Chamfer (41) teeth both sides.
Drill (3) 3/4 in. holes on 4.625 in. B.C.
Burr, wash and stamp per B/P.
Carburize and harden 57-62 Rockwell "C" sandblast.
Check for hardness—Navy witness.
On spline arbor—Grind OD, square flange face flush side and grind hub OD 1/2 way.
Surface grind hub face to clean up.
Opposite side—surface grind hub for distance through and grind flange face.
Surface grind flange face (hub side for face through distance).
Grind bore, finish grind hub OD and bearing surface.
Grind (41) teeth.
Chamfer splines in bore (hand ground).
Wash, demagnetize, shipping inspection.
Navy inspection.

W-S Products in Canada

The Watson-Stillman Co. has appointed Canadian Vickers, Ltd., Montreal, Que., to manufacture its entire line of hydraulic equipment in Canada. The Canadian Fairbanks-Morse Co. will continue to act as sole Canadian sales agents.

A HURRY!



FEDERAL RADIAL PROJECTION WELDER illustrates how odd shaped stampings of all kinds can be assembled with great economy and speed, by completing this eight-inch-diameter cooling fin assembly, 48 projection welds at once, in ten seconds.

FEDERAL MULTIPLE SPOT WELDER speeds stove production by welding this oven liner (on four sides at once) into a sturdy, economical sub-assembly.



NAME OF AUTHORITY IN RESISTANCE WELDING

The Federal
MACHINE AND WELDER CO.

220 DANA ST., WARREN, O.



(Advertisement)

VERSATILE MODERN PRODUCTION TOOLS

ALUMINUM WELDING SIMPLIFIED

Important developments in equipment for automatically resistance welding aluminum, accelerated by critical war demands, are now being applied to the speeding of production in every branch of industry, from the making of household utensils and appliances to auto bodies parts, and accessories.

Difficulties encountered in welding aluminum alloys were due to the narrow "margin of safety" in their thermal response. The extreme accuracy of timing heat and pressure required were difficult to attain until perfection of the "stored energy" principle combined with full electronic controls.

The Federal Machine and Welder Company, perfected the first successful welders built specifically for aluminum. In collaboration with manufacturers of electronic controls, this company developed the Federal Unipulse System, in which a capacitor bank is charged (during comparatively long periods between welds) to a precise voltage level, then discharged directly into the welder as a single, uni-directional current pulse for production of the welds.

Among the important advantages of current Federal Aluminum Welders are . . . increased welding speed, higher quality welds, increased volume of production per cleaning of electrodes and lower KVA demands on the power line. Remarkable uniformity and high mechanical strength make it possible to design parts where stress may be involved with a full measure of exactness not possible with old methods.

"TEAMING" METALS BY WELDING

More and more combinations of metals of different characteristics are being teamed into single "product-units" for reasons of economy of greater workability, because of the ease with which such metals can be permanently united by resistance welding. Stainless steel is saved in the making of knives and tools by flash welding to mild steel shanks . . . heavy axe heads are made with most of their weight in low-cost steel, to which high grade hardenable cutting edges are welded . . . innumerable combinations are possible in radio and instrument manufacture, where perhaps a high conductivity must be combined with good spring qualities, not found in any one metal . . . stainless steel can be used for heads of large diesel engine valves and still have stems of steel best suited to stem wear. The Federal Machine and Welder Company designs and builds welders for all of these types of production . . . offers its engineering facilities to anyone with similar problems.

10 TO 20 SPOTS PER SECOND

For fabricators of metal who have production involving ten to several hundred fastenings on one plane a special type of automatic spot welder is available in which automatically operated electrodes are set up in multiples, much like a gang drill. Power demand is comparatively low, as electrodes weld one at a time in rapid sequence. For high production, machines may be had with electrodes in any desired pattern.

Called Ultra Speed Spot Welders, these machines are made by The Federal Machine and Welder Company. Descriptive literature available on request. "Bulletin 515".

Handley-Page Manx



This radically designed plane recently made its appearance in England. It is a twin-engine, pusher propeller type with rudders in the wings. The cruising speed of this tailless plane is said to be 150 mph.

International News photo



OSHKOSH Truck and Trailer Equipped with TUTHILL Springs

RUGGEDNESS, large capacity, flexibility of use and hauling power are features combined in this special Oshkosh Heavy-Duty Truck and Semi-Trailer equipped with TUTHILL Springs.

For twenty-five years the Oshkosh Motor Truck, Inc., have been making heavy-duty four-wheel drive trucks and trailers, and equipping them with Tuthill Alloy Steel Springs. Proof of quality!

Tuthill makes a complete line of leaf springs, standard or special. What are your requirements?

TUTHILL SPRING CO.

760 W. POLK ST.

CHICAGO 7, ILL.



Quality Leaf Springs Since 1880

BOOKS...

BALL AND ROLLER BEARING ENGINEERING, published by SKF Industries, Philadelphia, Pa.

This 270-page book, a bound volume containing some 900 drawings and tables, begins with a technical description of common bearing types and continues through nine chapters of fundamental engineering studies. Both radial and thrust bearings are discussed comprehensively in Chapter I together with data on dimensional proportions, running accuracy and tolerances of each type.

"Forces and Motions in Bearings," the second chapter, is devoted to theory and calculations on such subjects as the nature of rolling resistance, friction torque, friction coefficients, stresses and deformations, load distribution, motion and inertia. Other chapters deal with studies in the carrying capacity of ball and roller bearings, bearing selection, design of bearing applications, mounting and dismounting, lubrication and maintenance and bearing failures. The final chapter is made up of tables, conversion values and a description of symbols and abbreviations.

First copies of the book will be sent by SKF to the heads of leading corporations, technical schools and colleges and libraries in principal U. S. cities. Later editions will be sold at cost by the Company for students and others interested in bearing studies.

PROSPECTS AND PROBLEMS IN AVIATION, 212 pages. Published by the Chicago Association of Commerce, Chicago, Ill., \$2.00, paper bound.

"Prospects and Problems in Aviation" presents a comprehensive review of the history and development of aircraft manufacturing and air transport and an analytical study of the postwar problems and outlook for both of these phases of aviation. The book consists of 12 papers given by 10 nationally known authorities at the recent Chicago Forum on Aviation, sponsored jointly by the Chicago Association of Commerce and the University of Chicago, and two supplementary articles.

The 14 chapters deal with the growth of the aircraft and air transport industries; prospective expansion of airline routes and services in the United States; prospective passenger and cargo traffic, rates and service; transport aircraft of the future; the future of the aircraft manufacturing industry; airport location, design and financing; competition or the community company in international air transport; regulation and taxation of air transportation; and the control and operation of air transports in relation to other forms of transportation.

INTERNAL COMBUSTION ENGINES (2nd Edition), by V. L. Maleev, Published by McGraw-Hill Book Co.

Although fundamental principles remain practically unchanged over long periods of time, the impact of research and development, changes in fuels and lubricants, improvements in materials, and the course of invention effect marked changes in current practice. The aim of the second edition of this textbook is to provide a thoroughly revised and up-to-date treatment of internal combustion engine design and theory stemming from the developments since the publication of the first edition some twelve years ago. In addition to these revisions the text also incorporates five new chapters: combustion in spark-ignition engines, combustion in compression-ignition engines, compression-ignition combustion chambers, supercharging, and a brief treatment of the gas turbine. The text is designed to give the student a well rounded foundation in the theory, design, and operation of internal combustion engines.

(Turn to page 82, please)

Combined Anodizing—Chromatizing

(Continued from page 34)

these openings. The pump is placed as near the floor as possible in order to provide the head usually required on the suction side of a centrifugal pump; the suction intake was placed 12 in. below the normal fluid level and 48 in. from the end of the tank farthest from the pump. This intake was connected to a four in. pipe line which in turn connected to the intake side of the pump. This provided a frictionless volume of liquid to the pump at all times. In this return line is placed the temperature bulb for the thermostatic steam valve. This thermostatic control, arrangement of the steam coils, and uniform agitation control the liquid temperature to a ± 1.0 F and permits heating the tank contents from room temperature to operating temperature in one hour.

The following calculation is a guide for pump agitation:

A one-quarter in. pipe bushing has a 0.504 in. diam hole.

A one-half in. nozzle discharging to atmosphere at 20 lb pressure will discharge 33.4 gpm. When discharging into a tank full of water it discharges about 30 per cent, or 10 gpm.

Desired time for change of tank contents = 20 min.

Tank capacity = 2000 gal.

2000
— = 100 gal to circulate each min.

20
100
— = 10 nozzles required for the job.

10
This equipment is common to all the fluid tanks, but otherwise each tank has special features of its own. There is a false bottom in each tank resting on the steam coils. It is made of one in. 16 gage wire mesh welded to a one in. pipe frame. This provides a method to recover any work which might fall from the work holders. In the anodizing tank the wire mesh is made of aluminum instead of steel.

The alkaline cleaner tank. In any liquid-containing tank where the liquid is replenished, an overflow precaution is necessary in order to keep the liquid level constant, to prevent the liquid spilling over the sides of the tank and to automatically skim off scum from the surface. To do this a slot is cut across one end of the tank, the lower edge being three in. below the top edge of the tank. The slot leads into a funnel outlet which connects with a 2.0 in. round pipe which terminates in the sump of the pit. The tank also has a 2.0 in. valved drain in the bottom. This drain is constructed by slitting a 2.0 in. pipe in half lengthwise for a length of 6.0 in. and welding it around a similar sized slot in the bottom of the tank. This, when connected to drain line to the sump, provides a low point drain when it is desired to completely empty the tank. Because operators are prone to permit cold water to continu-

ously run into a tank if a hydrant is convenient for doing so, no water inlet was provided at the rim of the tank. A hose bib is at the side of the tank and the operator replenishes evaporated liquid when necessary.

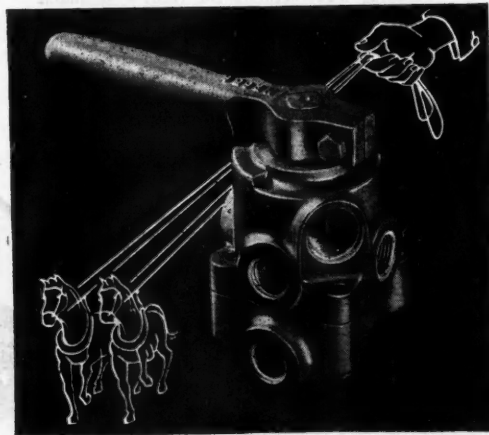
The hot rinse tank. On short tanks the above described overflow may be at the end of the rinse tank, but on long tanks it is preferable to put the overflow slots on the side. To form the trough a 4.0 in. by 4.0 in. by 0.5 in. angle is welded on the outside of the

tank so as to box in the slots. When the ends are closed in, a perfect trough is provided whose outlet connects to a 2.0 in. pipe which terminates in the sump of the pit. A valved drain is also provided. The angle used to form the box trough reinforces the edge and replaces the material cut away to form the slots.

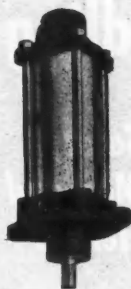
A thorough rinse is an important operation in the process and when the work is removed from the rinse all precaution must be used that no foreign matter is present on the surface of the liquid to stick to the work as it is removed from the rinse. To prevent this, (Turn to page 86, please)

* Embodies NOPAK Patented Cored-Disc Principle and other famous NOPAK features.

ONE VALVE



Controls Two Cylinders— it's the NOPAK* Dual 4 Way!



NOPAK CYLINDERS
—for Air or Low Pressure Hydraulic Power, available in Standard and Heavy Duty Types, with Adjustable or self-Regulating Cushions. 6 Standard Mountings.

This valve has proven its merit in many applications in which dual cylinders are used in close relationship. This valve is so designed that two cylinders may be actuated in either direction, in any sequence desired.

A variety of operating cycles may be set up . . . and governed by a single control lever. This is a decided advantage in manipulating inter-dependent machine movements. The Dual 4-Way embodies all of the performance features which you expect of NOPAK Valves . . . easy, finger-touch operation, precision control, freedom from grit-abrasion, long-lived, trouble-free service.

GALLAND-HENNING MFG. CO., 2774 S. 31st Street, Milwaukee 7, Wis.

Representatives in Principal Cities

NOPAK

VALVES AND CYLINDERS

DESIGNED for AIR and HYDRAULIC SERVICE

At present the NOPAK Dual 4-Way Valve is available in one size only, which may be used on pipe lines 1/2" or smaller.

A 4872-1/2IA

Never before were Timing Mechanisms so important!

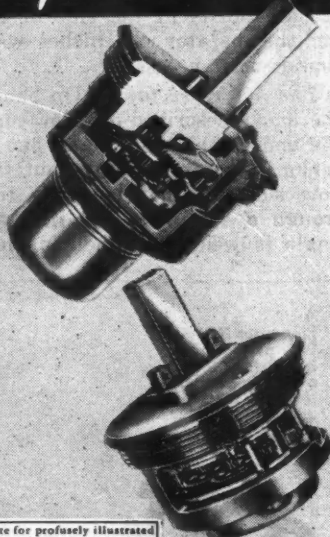
Tel-air

MEANS TODAY'S HIGHEST STANDARDS OF ACCURACY!

Tel-air's manufacture of timing mechanisms is exceptional. Tel-air production of bomb fuses (tiny timing mechanisms) is a story in itself. Preference of Tel-air by America's leading manufacturers for today's expanding market is another. Tel-air parts and assemblies are found precise and reliable by today's standards for long and severe service. Investigate! Resourceful engineering, tooling, and production are fine arts here.

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speed up sheet handling

with Safety for Men and Materials

C-F SHEET LIFTERS

... carry more sheets per load—faster and safer with no danger of dropped loads. Stack sheet stock—loose or bundled—higher, even, closer together.

Features insure maximum protection for both men and materials. Long carrying angles prevent damage to edges. Surface scratching of high grade stock is prevented.

One-man end operation or remote cab control keeps workmen away from danger point, plus eliminating need for extra aisle space. Cuts labor cost—no sling

crews necessary—accident hazard minimized.

Sliding lock bar (optional equipment) quickly adjusts legs to accommodate different widths. Tong action compensates for sag.

C-F Lifters are available in capacities from 2 to 60 tons or larger, in standard or semi-special designs to meet your specific requirements. Write for bulletin SL-21.

CULLEN-FRIESTEDT CO.

1309 S. Kilbourn Ave., Chicago 23, Ill.

a "skimmer" is provided. This consists of a 0.75 in. pipe the full length of the tank at liquid level, on the side opposite the trough, in which 0.125 in. holes on 4.0 in. centers are drilled. The holes point upward five deg from horizontal. After the load is submerged, water is turned into the "skimmer" and moving through the 0.125 in. holes with considerable velocity, it skims all foreign matter off the surface into the overflow trough.

The anodizing tank. Iron and steel is the only metal that can withstand the action of chromic acid solution. No form of brass, copper or bronze must contact the solution. If it does, at a solution temperature of 100 F its life is limited to a few days. Consequently the temperature bulb of the thermostat valve is stainless steel, the impeller of the agitation pump is steel and the packing gland and all other parts of the pump are steel; the packing used is Garlock No. 981 and although not entirely satisfactory, it is the best we have found so far. All valves on this tank are cast iron. As mentioned before, work holders are aluminum, even though they are short-lived.

The electronic action connected with the stripping action gradually reduces them to an unusable thinness. Since the tank is used as the cathode of the electrical circuit, precaution must be taken that the work does not come in direct contact with the sides of the tank. To prevent this, strips of wood 1.0 in. by 2.0 in. are fastened in a vertical position on 12 in. centers to the side of the tank. They are also on the bottom on top of the heating coils and the agitation nozzles. These slats gradually deteriorate and must be replaced at intervals. Only Douglas fir should be used.

Since chromic acid fumes are very injurious to the nasal tissues, a good ventilation system must be provided. It is obvious that an overhead hood would interfere with the work, consequently the downdraft type of exhaust is used. This consists of a series of slots along the sides of the anodizing and chromating tanks close to the top which lead into funnel shaped ducts (two on each side) which in turn connect into one large duct which widens out as it approaches the stack at one end of the tank. These funnel ducts have a tendency to equalize the suction of all the slots. The inside of all ducts and vents are acid proofed. The stack collects the exhaust from both sides of the tank and delivers the air through a chromic acid eliminator to the fan which discharges it to the atmosphere.

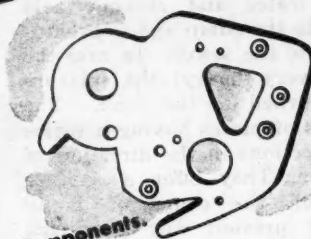
The chromic acid eliminator consists of a box in which a fine misty shower washes the air as it enters. A solenoid valve regulates the water supply so that water is running only when the system is in operation. To remove the moisture from the air stream it passes through a series of baffle plates, and the

(Turn to page 88, please)

How to Speed Production of Light Cases

These Plain Cyanide Baths Provide Desired Flexibility with Economy

1.



Description: Business Machine Components.
Steel: SAE 1020.

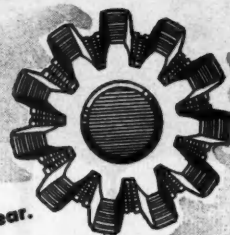
Specifications:

Case depth—0.002" measured on polished and etched section.
Hardness—File-hard after oil quench.

Treatment: 1500° F. for 5 minutes in 25-30% NaCN bath, then direct oil quench.

ADVANTAGES: Skin cases developed in extremely short treating times. High-nitrogen case means file-hardness, even with oil quenching of plain carbon steels.

2.



Description: Bevel Transmission Gear.
Steel: SAE 5140.

Specifications:

Case depth—0.005" measured on polished and etched section.
Hardness—File-hard. Rockwell C 48 to 52 after drawing.

Treatment: 1525° F. for 45 minutes in plain cyanide bath; oil quenched and then drawn.

ADVANTAGES: The cyanide bath is a clean heating medium which imparts a desirable file-hard, wear-resistant surface to the treated work.

FOR RAPID PRODUCTION of wear-resistant surfaces, Molten Cyanide baths are most economical. "Cyanegg" Sodium Cyanide, 96%, is used to best advantage for replenishing baths which have low drag-out losses. There are cyanide-chloride mixtures for increasing fluidity. Du Pont Case Hardener 30% gives a reducing bath for clean, economical reheating. Full case hardening activity in heavily worked baths is maintained with economy by employing 45% cyanide-chloride mixture. When the 75% cyanide-chloride mixture is used, moderate replenishments maintain case hardening activity and fluidity.

No matter what your case hardening needs may be, there are Du Pont heat treating products that will combine top production and maximum economy for you. Du Pont technical men are glad to assist you in selecting the best materials for your specific operations. Write: E. I. du Pont de

Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.



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... THROUGH CHEMISTRY

BIGGER BONDS FOR THE BIGGER SEVENTH

DU PONT
CYANIDES AND SALTS
for Steel Treating

mixture of water and chromic acid drains back to the sump and is eventually pumped to the sewer. In case the draw-off is very heavy, the mixture could be returned to the tank. The baffle consists of plates having a series of angle deflections in the direction of the air flow. They offer a surface against which the drops of liquid impinge and prevent any entrained moisture from being carried out with the air stream. The area of plate (one side only) is equal to 0.035 sq ft per cu ft of air passing through the eliminator. Air velocity through the eliminator should be about 500 fpm. In order to obtain air velocity of 25 fpm in the center of the tank and 800 fpm

at the slot, a transport velocity of approximately 2000 fpm is required. To move this air a three hp 3000 cfm paddle blade type fan is used.

The low ceiling of the room assigned to this operation made head-room a premium and consequently the cover for the drying tank could not be made to lift on a hinge. To overcome this the cover was made to slide open. To do this, two long air cylinders (one on each end of the tank) attached to the cover and so placed that, when sliding on a track, it could be drawn back, so the opening in the tank was completely exposed to admit a load of work, which after being lowered into the tank, permit the cover to close. This prevents

the unnecessary escape of heated air. The steam coils are covered with a false bottom which extends from one end of the tank to within two ft of the other; 5000 cfm of air circulates over these coils, up through the gap at the end of the false bottom, over the work and is withdrawn at the same end of the tank that it entered, to be recirculated by a powerful fan. The temperature bulb operating the thermostatic valve on the steam coil is in this air stream. The dryer is insulated with two in. of fibre glass. No provision was made for the automatic admittance of fresh air into the circulating air and experience has shown that none is needed. The cracks between the cover and the rim of the tank seem to provide all the fresh air that is necessary.

The master control panel was made as simple as possible and consists of push buttons and green indicator lights. The exhaust fan and agitation pump for the anodizing and chromating tanks are connected to a single control, and the tanks are individually controlled. The agitation pumps of the alkaline wash tank and the two rinse tanks are inter-connected and operate from a single control. The dryer is individually operated. However, all controls, including the crane, are connected to one master control which operates the room ventilating fan; nothing can be operated unless this fan is in operation. A safety switch is located between the hot rinse tank and the anodizing tank along the passageway; when it is pushed, everything in the system is instantly stopped; in order to restart, it is necessary to operate from the master control panel.



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OF ALL KINDS OF SPRINGS TO MEET
YOUR PARTICULAR REQUIREMENTS**

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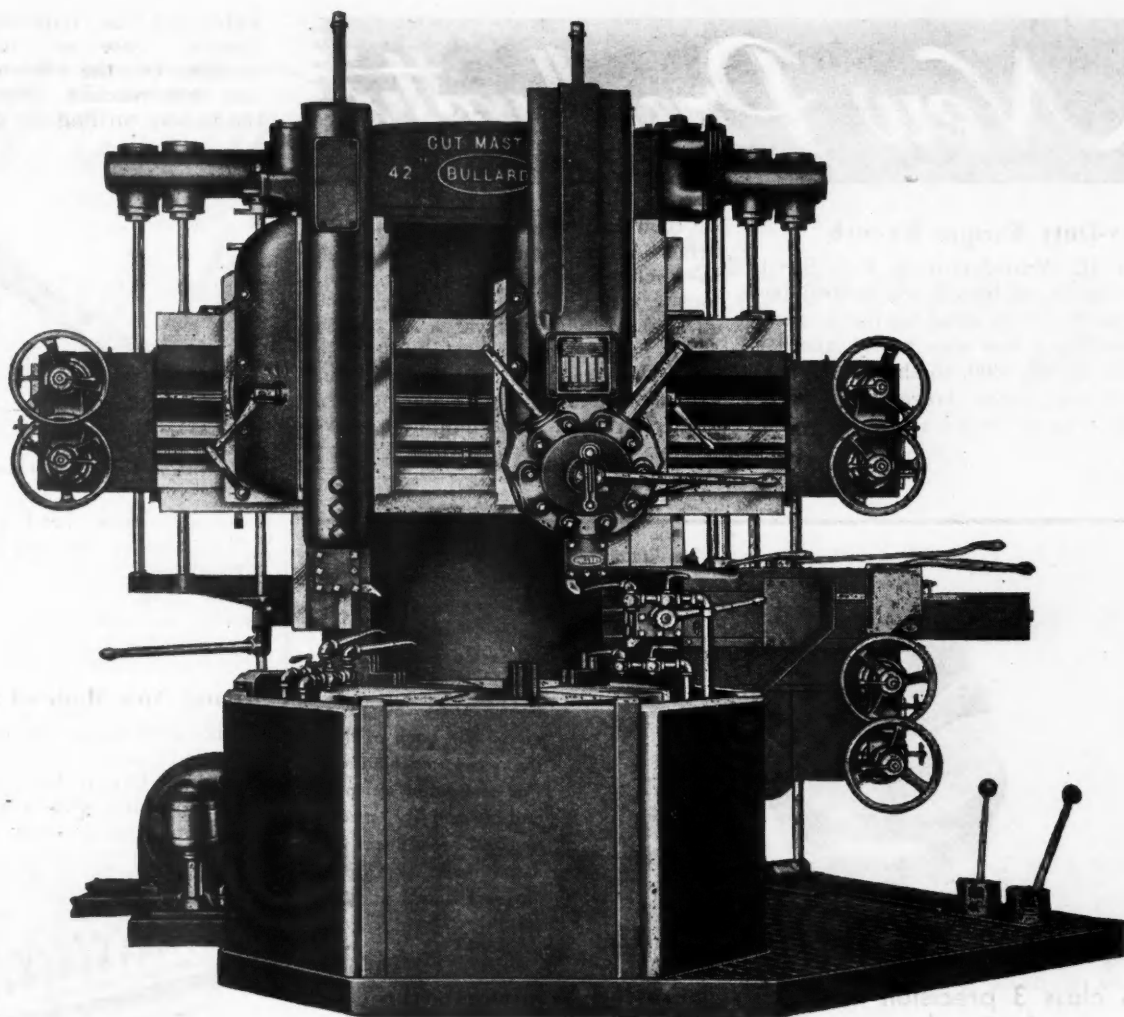
Annual Meeting of IRC

An annual meeting of the members of the Independent Research Committee on Cutting Fluids was held in Detroit on Oct. 10, according to an announcement by Joseph Geschelin, chairman. Organized about eight years ago for the purpose of studying the utilization of cutting fluids, improving commercial practice, and the preparation of recommendations for metal cutting establishments, the IRC has presented papers on these subjects before the principal engineering societies. Its manual on cutting fluids recommendations and machinability tables for the commonly used engineering materials has been widely used and incorporated in handbooks and bulletins.

At the present time, the IRC has initiated five major projects of interest:

1. Definitions and nomenclature
2. Refrigeration of cutting fluids
3. Study of Industrial Dermatitis
4. Survey of machining practice in the aircraft industry
5. Revision of the machinability tables

The IRC is interested in the problems of metal cutting plants and will be glad to study special problems upon request.



ONLY BULLARD CUT MASTERS HAVE ALL THESE COST-CUTTING FEATURES

Features that Cut Time on Cuts

1. On five sizes, 30" up to and including 64", the base and upright column is a massive integral casting for vibration-free sturdiness and rigidity. This permits heavy, accurate cutting. 2. Swiveling main turret head and independent, non-swiveling side head for simultaneous heavy cutting without interference or lost time. 3. Sixteen feeds for each head in geometrical progression from .0026 to .500 per spindle revolution . . . 20 table speeds . . . motor ratings 30 to 40 HP — *all* adequate for fast heavy cutting. 4. Screw feed of main head for highest degree of machining accuracy under heavy feeds. 5. The ideal combination of rigidity, sturdiness, freedom from vibration, smooth flow of power and wide range of speeds and feeds to take full advantage of the higher efficiency of the latest development in cutting tools.

Features that Cut Time between Cuts

6. Vertical construction that speeds chucking because it is easier to lay a piece down than to hang it up. 7. Chucks designed to provide maximum jaw pressure with minimum wrench effort. 8. Quick, easy adjustment of main rail to place turret close to work and eliminate excessive tool overhang. 9. Rapid power traverse in any direction, accurately controlled to bring

tools quickly, safely within a fraction of an inch of the work.

Compare Bullard Cut Master Vertical Turret Lathes' efficiency and economy with other machines of the same type. You'll find that only a Cut Master has the metal-removing ability and *all* the other features that *cut time on and between cuts* to the minimum. Cut Masters are available in 30", 36", 42", 54", 64", and 74" sizes. The Bullard Company, Bridgeport 2, Connecticut.

From Government Machine Tool Surplus Lists, select the better machines to replace obsolete models you've been using on non-critical work. Ask Bullard for information on your selection of government surplus machines by machine serial number.



**CREATES NEW METHODS
TO MAKE MACHINES DO MORE**

November 1, 1945

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New Products

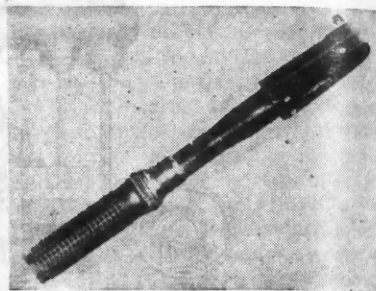
Heavy-Duty Torque Wrench

The JO Manufacturing Co., South Gate, Calif. has introduced several improvements in its Jomi torque wrench. The company has also added another wrench, Model 1600, to the line. Model 1600 is an extra large, heavy-duty wrench with a torque range from 700

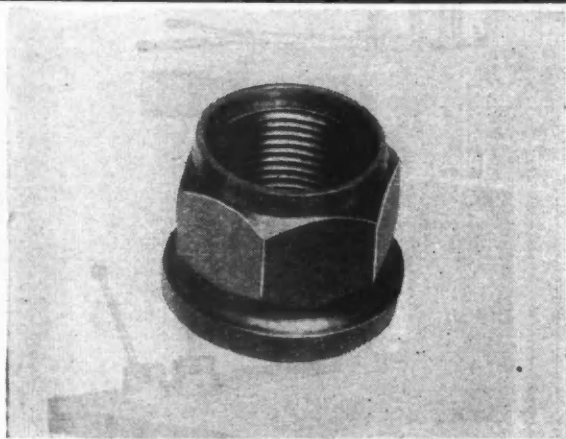
to 1600 in./lb, and a $\frac{1}{2}$ in. standard drive. At the same time Model 600 has been changed to Model 750, with a torque range of 100 to 750 in./lb, and a $\frac{1}{4}$ in. standard drive.

All moving parts pertaining to the torque control feature of the wrench are now ballbearing, reducing error due to friction to a minimum. Over-

tightening is impossible with the wrench. Once set, it automatically breaks when the predetermined torque has been reached. The operator sets the tool by turning the guide to the de-



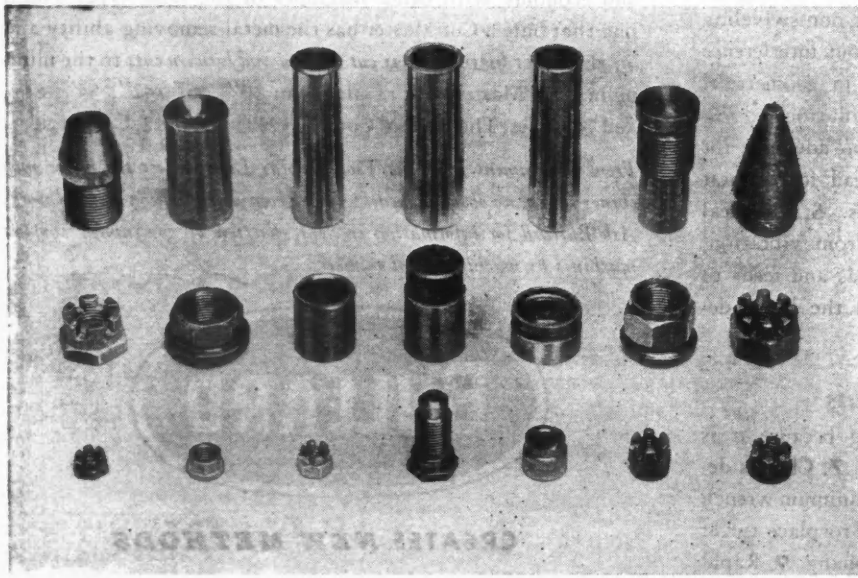
Model 1600 torque wrench



This is one of the group of samples of precision parts (illustrated below) of ferrous and non-ferrous alloys that have been made by Bessemore. On each of them, the screw machine work was completed within ten and twenty-five seconds and .002" tolerances were maintained. The grinding work is held to .0001" (tenth).

A class 3 precision nut with full crested Whitworth thread made of siliconbronze. The face of the nut is square with the pitch diameter within .001" indicator reading . . . BESSEMORE specializes in precision screw machine manufacture . . . making more of them better. Our engineers will be glad to make recommendations without obligation. . . . Send us your blueprints.

BESSEMORE PRODUCTS CO.
13243 EAST WARREN AVE.
DETROIT 13, MICHIGAN

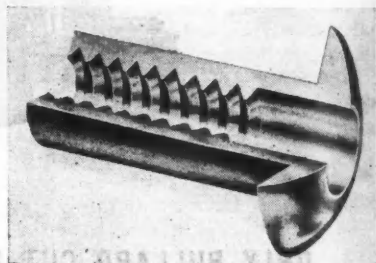


sired micrometer reading on the barrel.

The rubber capped head has been discontinued and in its place is an all-metal head. Both the head and the handle are now made of heat treated aluminum.

Rivnut Now Made of Steel

The Rivnut, a one-piece internally threaded and counterbored tubular rivet which can be upset or headed from one side with a simple tool and used as a blind rivet, nut plate for



Cutaway section of brazier-head steel Rivnut

attachment, or both, is now being made in steel, according to the B. F. Goodrich Co., developers of the fastener.

Originally made only in aluminum and then also in a brass alloy, extension to steel will allow much greater utilization of the product, the company believes. The aluminum Rivnut was initially used for airplane industry applications, but the field has been broadened to include many other services.

The new standard steel Rivnuts are made in 6-32 thread, 8-32 thread, 10-32 thread, 12-24 thread, $\frac{1}{4}$ in. 20 thread and 5/16 in.-18 thread. They can be made in special sizes on order.

An additional head style, the brazier head, is introduced. The trailer and bus industry are using this because of the ease of cleaning, there being no sharp edges around the head.

Optimus Deoxidant No. 3

Highly satisfactory results removing flux, and welding and brazing scale using Optimus Deoxidant No. 3, are (Turn to page 92, please)

★ *An Important Factor in Your Post-War Planning*

To meet post-war competition, plan to use Landis Threading machines and equipment exclusively for smooth operation and increased production at lower cost. Hundreds of America's foremost manufacturers have met seemingly impossible schedules with Landis during the war years and now are planning to meet post-war threading problems with Landis equipment.

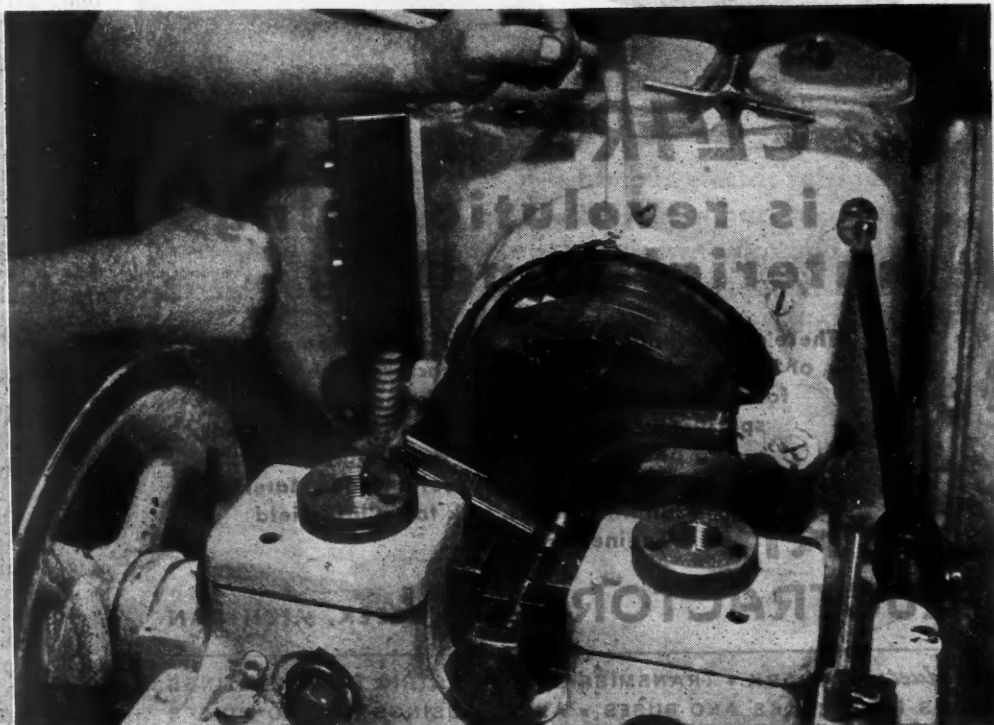
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LANDIS MACHINE COMPANY

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THREAD CUTTING MACHINES • DIE HEADS • COLLAPSIBLE TAPS • THREAD GRINDERS

A manufacturer of Naval Hardware employs Landis Thread Cutting Die Heads and Machines exclusively for threading countless thousands of threaded components used in the world's mightiest battle fleet.



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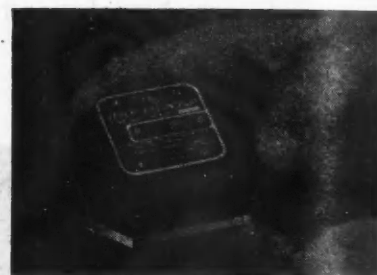
Products of CLARK • TRANSMISSIONS • ELECTRIC STEEL CASTINGS
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reported by its maker, Optimus Detergents Co., Matawan, N. J. It is being used to deoxidize the surfaces of a wide variety of metals and alloys.

Not a bright dip, and not intended to replace acid in ordinary pickling, Optimus Deoxidant No. 3, being acidic in nature, may be used on most metals as a mild deoxidant without serious etching of the surface. It is used regularly on welded steel tubing, brazed, hot rolled and cold rolled steel, copper, brass, welded aluminum, cast iron, bronze castings and most aluminum alloys.

Vibration Pickup for Industrial Applications

The MB Manufacturing Co., New Haven, Conn., has placed on the market a vibration pickup designed to diagnose industrial vibration problems. Developed to meet the requirements of aircraft engine testing, this pickup features high output signal level, freedom from frictional effects



MB vibration pickup

limiting response at low amplitudes, and stability of calibration over wide-temperature ranges. Output is proportional to vibratory velocity, with uniform response from below 10 cps to approximately 1000 cps, and usable response to 4 cps. The pickup is usually operated as a seismic instrument, but can be furnished with provision for direct attachment of the extremely light moving coil to structures whose vibration might be influenced by a heavier mass. Pickups are furnished with a special flexible pigtail lead, and are quickly converted for use in either horizontal or vertical planes without affecting calibration.

New Type Fastener

Known as the Huck Lockbolt, an entirely different type of fastener is announced by Huck Mfg. Co., Detroit, Mich. The lockbolt first draws the work tightly together in the equivalent of a bolting-up operation, after which it is permanently locked in place like a rivet.

The Huck Lockbolt consists of two parts, a pin and a locking collar. The pin has a head of any desired shape, locking grooves, a breakneck groove, and pull grooves which fit the jaws of the driving gun.

(Turn to page 94, please)

**This
little bolt
does a job
that's**

BIG

This little bolt does a big job in the compressor unit of a famous electric refrigerator. Once it was a problem child because it had to be machined individually from bar stock. Now Buffalo Bolt engineers have devised a process of shaping it out of drawn wire and threading it in a single, fast and economical operation. Another example of the versatility of our modern equipment.



BUFFALO



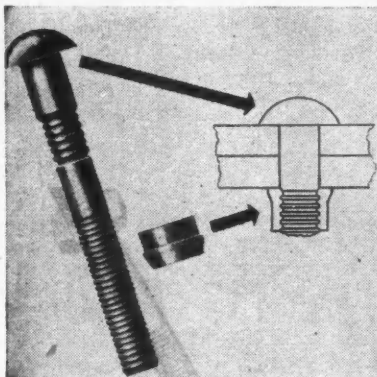
BOLT COMPANY

**NORTH TONAWANDA, NEW YORK
SALES OFFICES IN PRINCIPAL CITIES**



Each of this battery of Buffalo Bolt roll threaders has a capacity of 43,000 bolts per working day.

After the pin is inserted in the work, the collar is slipped on and the gun applied. Both hand-operated and pneumatic guns are available. As the gun pulls the pin, the reaction is taken by the collar against a swaging anvil in the nose of the gun, thus drawing the work tightly together. The pull on the pin is then increased until the anvil is forced over the collar, squeezing the collar into the locking grooves of the pin to form a rigid, permanent lock. The pin is then automatically broken off at the breakneck groove, after which an ejector member in the gun advances to push the anvil off the collar, completing the operation.



Huck Lockbolt

Ingenious New Technical Methods

To Help You with Your Reconversion Problems

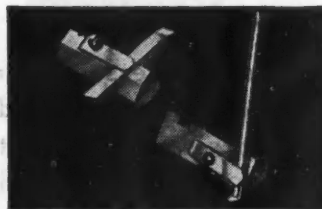
NOW ANYONE CAN GRIND THREADING TOOLS! — WITH MASTER GRINDING GAUGE!

Until the advent of the Acro Master Grinding Gauge, only a skilled mechanic could grind thread-cutting tools to the required degree of accuracy. Now anyone can do it—in less time, with less waste, with even greater precision!

The cutting tool is simply placed in slot of the Master Grinding Gauge, and thumb screws hold it tightly in place, at the proper angle, while being ground on any type of surface grinder! The Gauge is made of hardened tool steel. There are no delicate or moving parts to get out of order. Milled slots at top and bottom provide correct grinding angles. A small set screw at end, eliminates any lateral motion. There is nothing special to learn—anyone can use it!

Anyone can be "helped on the job" by Wrigley's Spearmint Gum, too, once this quality product again becomes available. Just now, no Wrigley's Spearmint Gum is being made, and until conditions permit its manufacture in quality and quantity for everyone, we again urge you, please, to "Remember the Wrigley's Spearmint wrapper." It is our pledge to you, of the finest quality and flavor in chewing gum—that *will* be back!

You can get complete information from:
Acro Tool and Die Works, 4554 Broadway, Chicago 40, Ill.



Acro Master Grinding Gauge



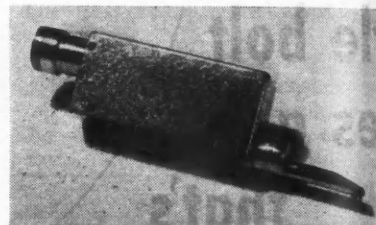
Remember this wrapper

Z-90

Tracer Increases Profilometer Versatility

The range of surfaces on which roughness measurements can now be taken is increased by the introduction of the new Type AW Profilometer tracer by Physicists Research Co., Ann Arbor, Mich. Used in conjunction with the Profilometer, the Type AW tracer is said to greatly increase the versatility, efficiency, and convenience with which Profilometer measurements may be made.

The Type AW tracer may be used to measure the roughness of surfaces on all outside diameters and on all inside diameters down to 1/4 in. The tracer will also measure both internal



Type AW Profilometer tracer

and external tapered surfaces and gear teeth.

No adaptations of the equipment are necessary to use the Type AW tracer with all types of Profilometers now in use.

Pipe Sealing Compound and Gasket Cement

Bowser, Inc., Fort Wayne, Ind., has developed a pipe sealing compound and gasket cement for gasoline, oil and other petroleum-base solvents. Known as Black Magic, it is said to form a permanent seal in pipe joints or gaskets, and to retain enough flexibility to permit expansion and contraction of metals without cracking. It does not become brittle with age. The new compound is put up in various size containers from 4-oz tubes to 50-gal drums.


Self-Cleaning Magnet For Tramp Iron Removal

The Dings Magnetic Separator Company of Milwaukee is offering a new self-cleaning, rectangular, electro-magnet for use where a large amount of miscellaneous iron is to be separated. The unit is made completely automatic in operation with the aid of a cross-belt that conveys tramp iron to a discard pile, instead of allowing it to affix to the magnet face and later drop back on the main belt in case of a power interruption. Also, the self-cleaning magnet does away with the down time formerly necessary for discharging iron and scraping from the belt.

Non-magnetic angles riveted to the cross-belt plus a fast belt speed are said to assure quick removal of tramp iron from the magnet face so that on-
(Turn to page 96, please)

Bunting manufactures not only Special Bearings to your specification but Standard Stock Bearings and Precision Bronze Bars. On Special Bearings our engineers will be glad to work direct with you. Standard Stock Bearings and Precision Bronze Bars are available from your nearest Authorized Bunting Distributor. The Bunting Brass & Bronze Company, Toledo 9, Ohio.

28



Bunting

BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

November 1, 1945

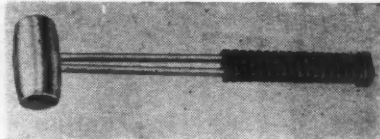
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95

coming iron cannot pile up and clog this area. Also, the new Dings Separator principle prevents iron from forming over the magnet in a layer that might drag material being passed on the lower conveyor belt.

Wide-Utility Lead Hammer

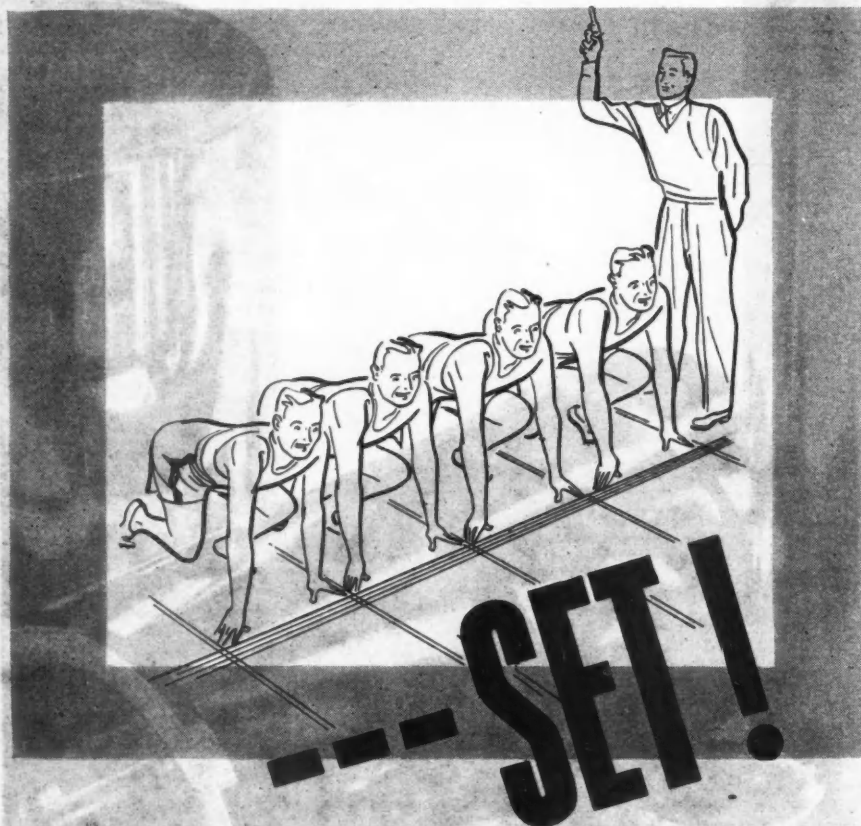
Originally incepted for a specific purpose in aircraft manufacture, a lead hammer produced by Nu Products Co., Newark, N. J., is now being used in other phases of industry. It is made of tellurium lead with an antimonial content which is said to minimize wear and practically eliminate danger from



Lead hammer made by Nu Products Co.

flying chips and splinters as the head actually toughens with use.

The shaft is a double steel rod, cadmium plated. Welded cross members on both ends absorb shock and impact. The serrated handle is of plastic with a safety bulge at the end. Weight of the head is five lb.



IT HAS SOUNDED—the first call for the peacetime sprint for industrial markets. And it's the last call for examining your product and plant to make sure that both are in the pink of competitive condition.

Wouldn't it be wise to talk bearings with Aetna?—to investigate better, more effective applications for both plant and product.

Just the minute that Aetna's war production obligations are fulfilled, Aetna can start making bearings for your peacetime requirements—no reconversion lag.

As a smart first step—call Aetna.

AETNA BALL AND ROLLER BEARING CO.
4600 Schubert Avenue • Chicago, Illinois

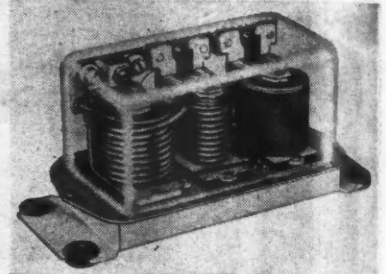


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Voltage Regulators for Trucks and Buses

Improved 3-unit, vibrating type, heavy-duty voltage regulators for low voltage d-c generator application are now being offered by R-B-M Manufacturing Co. (division of Essex Wire Corp.), Logansport, Ind. These regulators are especially suitable for commercial trucks and buses, and industrial material-handling trucks. All three units—reverse current relay, voltage control, and current limiter—have bal-



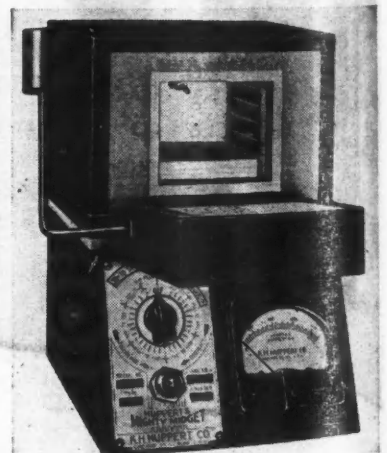
RBM voltage regulator

anced armatures to minimize possibility of erratic operation due to external vibration and shock. The complete assembly is sealed in a gasketed, drawn steel enclosure—dusttight and waterproof.

These R-B-M voltage regulators are available in maximum capacity of 45 amp. at 6 to 32 volts direct current. Maximum field current rating—3 amp at 6 volts; 0.5 amp at 32 volts direct current. Approximate dimensions—width, 7 1/4 in.; depth, 4 in.; height, 3 1/2 in. Average weight, 3.25 lb.

(Turn to page 98, please)

Midget Furnace



This small electric furnace which has been added to the line of the K. H. Huppert Co., Chicago, Ill., is only 8 1/2 in. by 10 1/2 in. by 8 1/2 in. Its inside dimensions are 3 in. by 3 in. It is equipped with built-in, automatic control that maintains any desired temperature between 200 F and 1750 F. Named the "Mighty Midget", it operates on 110 volts, alternating current, and consumes 500 watts.



BONDERITE

FOR ZINC AND CADMIUM

FOR PRODUCING ON ZINC, CADMIUM AND THEIR ALLOYS, A PHOSPHATE COATING, WHICH INHIBITS CORROSION AND INCREASES THE ADHESION AND RESULTANT DURABILITY OF APPLIED PAINT FINISHES.

A TECHNICAL PUBLICATION FROM
PARKER RUST PROOF COMPANY • DETROIT 11, MICHIGAN

Zinc and Cadmium, too, can have the added qualities of corrosion protection and increased finish life through Bonderizing. The Bonderite process for Zinc and Cadmium:

- ★ Provides a uniform coating.
- ★ Penetrates small apertures and recesses readily. (Important in treating complicated diecast, threaded or intricate parts, where corrosion or change in dimension might affect assembly or operation.)
- ★ Does not materially affect mechanical dimensions.
- ★ Is insoluble in water and impervious to normal, elevated drying or baking temperatures.
- ★ Does not require elaborate equipment or highly skilled personnel.
- ★ Provides an excellent base for paint.

Write for New Technical Bulletin just published giving full information on Bonderite for Zinc and Cadmium.

PARKER RUST PROOF COMPANY

2178 E. Milwaukee Avenue • Detroit 11, Michigan



Untreated zinc coated surface, after 6½ years outdoor exposure, shows corrosion and loss of paint adhesion.

Bonderite coated zinc, after 6½ years outdoor exposure, still in good condition.

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HOLDS PAINT TO STEEL

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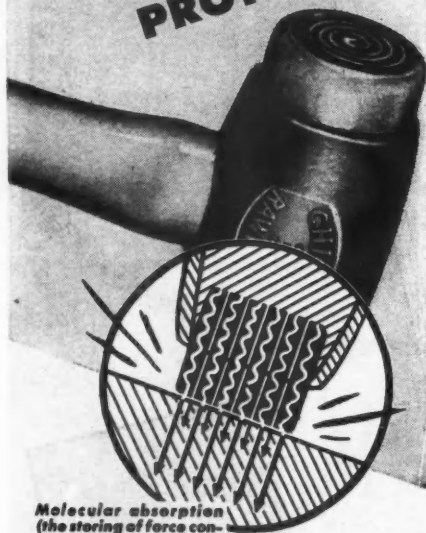
November 1, 1945

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PROTECTS



Molecular absorption
(the storing of force con-
veyed through the tough
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velocity into effective
thrust.

By momentarily storing the force of a blow and "slowing the punch," the coiled and compressed rawhide in C/R Hammers and Mallets (1st) takes the shattering crash out of powerful blows . . . prevents breaking, disfiguring or marring of products, machines and fine finishes. (2nd) eliminates recoil—ends the fatiguing bounce common to most mallets.

With a C/R Hammer you can use a lighter tool, still strike harder and more effectively; can accomplish more with less fatigue; because striking force is mono-directional with more carry through.

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Airplane Materials Used for Industrial Equipment

Northrop Gaines, Inc., a subsidiary of Northrop Aircraft, Inc., is using airplane fabricating techniques in constructing hand trucks and industrial wheels of light metals.

First item ready for the market will be industrial wheels, cast solidly of aluminum and with hard rubber tires molded firmly on the wheels. These wheels, now being built in six-, eight-, 10- and 12-in. diameters, are designed for use on hand trucks, dollies and all rollable industrial equipment.

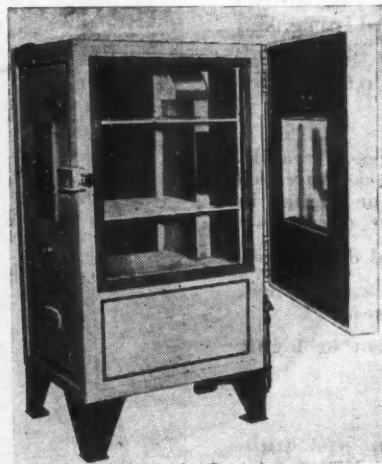
Although they weigh as little as three lb, the Northrop Gaines wheels are said to carry 40 per cent more weight than any wheel of equivalent size, and are equipped with Timken tapered bearings, which require no lubrication during the life of the wheel.

Northrop Gaines also is in production on a line of hand trucks with frames cast in one solid piece of aluminum. Smallest of three sizes weighs only 36 lb.

Cabinet for Simulation of Atmospheric Conditions

An insulated variable temperature and humidity chamber for the simulation and control of atmospheric conditions has been brought out by Tenney Engineering, Inc., Newark, N. J.

Cabinets are designed to provide accurate simulation and control of any desired temperature, humidity and air circulation condition in laboratory or production testing operations. Batches or parts can be tested under standard



Tenney variable temperature and
humidity chamber

or variable conditions. Temperature, humidity and air circulation can be controlled to close pre-selected limits.

Conditioned air is kept in continuous forced circulation without undesirable draft. Uniform wet and dry bulb temperatures throughout the cabinet are thus provided.

Dry bulb temperature of the air can be set from room temperature to any (Turn to page 100, please)



"Centerville" Is Putting In a LAYNE WATER SYSTEM

"Centervilles" throughout the nation are rapidly graduating from town-pump villages. Their growth and stability as cities of lovely homes, fine business houses and progressive citizens has called for the installation of a modern water system. Officials of "Centerville" are beginning right—taking no chances on water supply failure—expensive operation, or short life of wells and pumps. They are putting in a Layne Well Water System. Investigation has shown "Centerville's" officials that a Layne Well Water System is easily within their means and is a sound and profitable investment.

These same kind of Layne Well Water Systems and Layne Vertical Turbine Pumps are serving the nation's largest cities—the greatest industries, biggest railroads, and the most extensive irrigation projects. Layne water producing equipment enjoys the reputation of being the world's best—and that reputation is constantly growing stronger and stronger.

Layne offers fine and always dependable Well Water System counsel with no obligation. For further facts, catalogs, etc., address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

HIGHEST EFFICIENCY

Layne Vertical Turbine Pumps are now available in sizes to produce from 40 to 16,000 gallons of water per minute. Their high efficiency saves hundreds of dollars on power cost per year.

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VERTICAL TURBINE PUMPS**

Civilian Production means Press Production

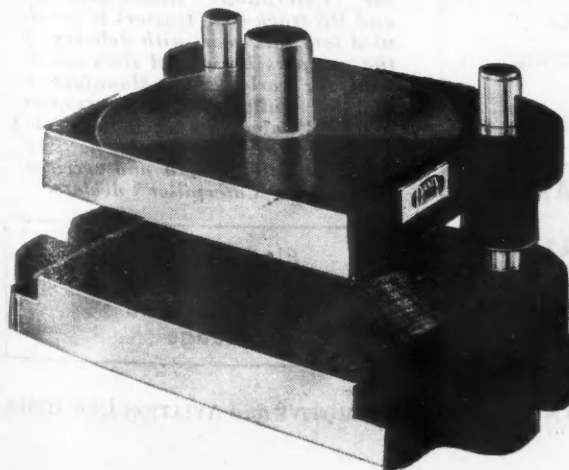


Stampings played a major part in the streamlined conversion of America's facilities to war production. In reconversion to civilian production, they will play a similar, or greater part.

The greatest possible use of stampings is the fastest way to speed production—in war and in peace.

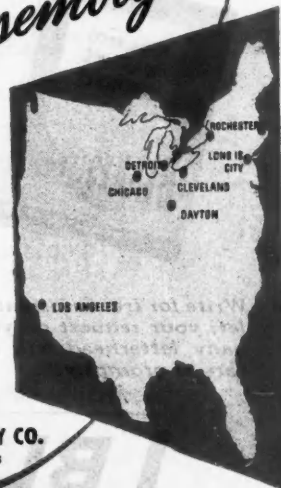
DANLY PRECISION DIE SETS will speed your stampings production in diemaking—and in manufacture—because of their *known dependable accuracy*.

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2100 South 52nd Avenue, Chicago 50, Illinois



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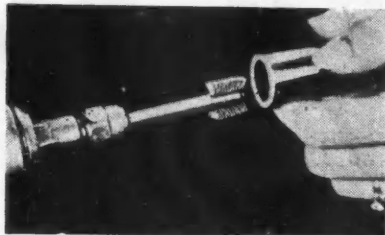
DANLY DIE SETS

Welded Steel Fabrication

desired point. It is said that when the unit is operating, this temperature does not vary in any part of cabinet by over 1C plus or minus.

Improved Power Brushes

A new series of "Situft" power brushes is now in production at the Osborn Manufacturing Co., Cleveland, Ohio. These brushes are available in a variety of sizes. Outside diameters range from ¼ in. to 1 ¼ in., brush face lengths from 9/16 in. to ¾ in., stem diameter from 3/32 in. to ½ in., overall length from 2 ¼ in. to 2 ¾ in. and the gauge of wire used are .003 and .005 in. Ship-



Situft brush

ping weight ranges from two to four and one-half ounces.

They have been tested on both long and short shafts for close-tolerance op-

erations, for removing insulation, rust, mold marks and for a large number of operations requiring deburring or removal of material from small, inside diameters.

One of the holders designed for many production operations fits into the standard ¼-in. chuck of portable air and electric tools and an efficient method has been devised for inserting or removing the brush from holders with pliers.

Mounted Point Utility Kits

A complete line of mounted point utility kits is now offered to the trade by Abrasive Co., Philadelphia, Pa.

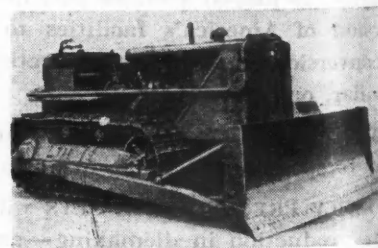
Utility kit MP21 contains 20 mounted wheels and points and an Electrotron dressing stick for dressing the points and altering shapes for special applications. Utility Kit MP9 contains nine mounted wheels; kits MP7A and MP7B each contain seven points. The MP7A kit covers the smaller type points for jobs requiring finer work or presenting hard-to-get-at spots.

New Products for Aircraft

(Continued from page 74)

The ATR-3 weighs only 12 ¾ lbs, measures 4 ½ in. high by 5 ½ in. wide by 8 in. deep, and will operate on a 6 or 12 volt synchronous vibrator power supply. Standard equipment includes tubes, crystal, headset, and push-to-talk aircraft microphone. Available equipment consists of loudspeaker, loop antenna system, and trailing antenna with reel.

Caterpillar Bulldozer



"Caterpillar" cable-controlled bulldozers and scrapers are now in production at Caterpillar Tractor Co., Peoria, Ill. Delivery of bulldozers for "Caterpillar" Diesel D8, D7 and D6 track-type tractors is scheduled late this year, with delivery of the scrapers in several sizes scheduled for early 1946. Manufacture of the bulldozers and scrapers marks "Caterpillar's" entry into this field of industry. The new products will be sold and serviced through "Caterpillar" dealers.

**Pledge Victory
with a
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Pledge**



... For over fifty years, G. S. Blakeslee & Co. have been engineers of cleaning equipment. A great many problems have been solved and many bottle-necks in the production line have been eliminated with Blakeslee Metal Parts Washers and Solvent Degreasers.

Numerous cleaning problems are encountered daily which are being solved by G. S. Blakeslee & Co. Let us give you the benefits of our broad experience in solving your cleaning problems.

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Steel Cross Sills

(Continued from page 29)

First, a steel cross sill bearing directly upon this wood should not be allowed because when heavily loaded the cross sill will sink a bit into the wood bearing member. Later as the body is unloaded the cross sill can then reflect back into normal position which may leave the cross sill out of contact with the wood longitudinal bearing channel.

Second, the wood itself may not be completely seasoned and might tend to shrink away from some of the cross sills while actually warping into closer contact with others thus causing certain cross sills to carry overloads while others have to twist or bend down to pick up any load at all. To overcome these difficulties it is recommended that the body builder be sure to use the steel clapping or bearing angle or channel such as those shown in Fig. 5B, 5C or 5D. Steel caps of this nature float the load to be transferred from the cross sill to the longitudinal sill over a much multiplied surface area. This prevents cutting into the wood longitudinal member and in cases of shrinkage the cap or bearing channel helps to float the steel cross sill over the shrunken area of the wood longitudinal section. Body builders who have been using this method report it to be a great future-trouble saver.

Before leaving the subject of cross sills it will be well to point out the relative factors to consider in the use of special low depth cross sills such as are sometimes necessary when building to a low loading height as in a wheel pocket job. To use a common expression these low sills are definitely "weak sisters" and should be used only in cases where it is absolutely unavoidable. To illustrate let us look back at the load conditions in Fig. 3. Here we have a total tension on the wire or compression on the ball of 6571 lb. Now suppose the depth of this cross sill was only 3.25 in. instead of 5.25 in. and the loads applied remained the same. In this case the tension and compression loads would go up to 34,500 divided by 3.25 which would be 10,615 lb as compared with the 6571 lb exerted on the flanges of the deeper sill. This is much too close to the actual yield point of the flange material and in this particular case more cross sills would be required to properly carry the loads. Here also the tendency of the flange to buckle is greater because of the severe increase in compressive load.

As a general rule where bodies are to be from seven to eight ft wide the most practical steel cross sill depth lies between five and six in. where these cross sills are used over the tops of chassis frames. In the case of a frameless trailer a different problem is encountered and without the chassis rail supports at the center these cross sills should be considerably deeper due to the longer unsupported width span.

Cross sills of this nature, however, are not so subject to buckling because in this case the load forces are all changed around, the reaction force occurring at the end of the sill where it hangs from the body and the compression is now changed to the top and the tension changed to the bottom flange. Here the greatest tendency towards buckling lies along the top flange at the center of its span. In this case attachment of the flooring helps resist the buckling.

Another important detail which

should be observed is the welding technique used in the welding of cross sills at or near the reaction point. Some high tensile steels lose a great share of their strength at the point of weld when subjected to welding heats. To weld across a section is the same as reducing the strength by cutting across the section. Because of this all weld lines should be parallel with the running length of the cross sill or directly across the cross sill bearing angle or channel.

Tie down holes should never be drilled through the bottom flange of a steel cross sill. A hole out at the mounting point is nearly as bad as reducing the

(Turn to page 104, please)

In the Bendix-Weiss Rolling Ball Universal Joint



STROM BALLS
Serve the Armed Forces

Here, in the Bendix-Weiss Constant Velocity Universal Joint, Strom Balls do their part in making military vehicles, from Jeeps to 14-ton Armored Cars, the efficient fighting equipment that they are. This is only one spot in our great war production effort where the high degree of perfection of Strom Balls serves industry, enabling it to provide the finest bearing equipment towards its great contribution to total victory. Strom Steel Ball Company, 1850 South 54th Avenue, Cicero 50, Ill.

Largest Independent and Exclusive Metal Ball Manufacturer

Strom BALLS  **Serve Industry**



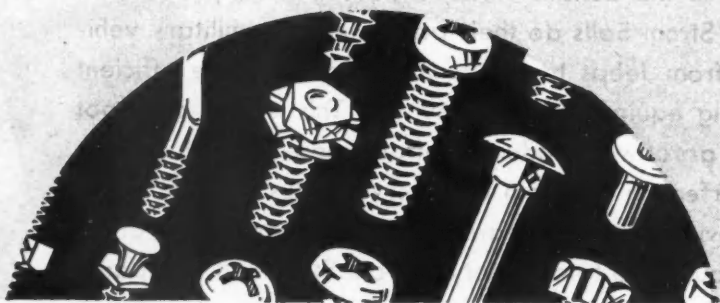
RECONVERSION TO PEACE-TIME PRODUCTS MADE EASIER

by using **HOLTITE** fastenings

You can change over to post-war production with no fastening worries by adopting HOLTITE as standard practice in every fastening operation. New HOLTITE fasteners, developed and perfected for weapons of war, will lower your assembling time and costs. Our Engineering Department welcomes the opportunity to study fastening problems in your reconversion plans. Let us know the difficulties confronting you and we'll make practical recommendations for their most economical solution.

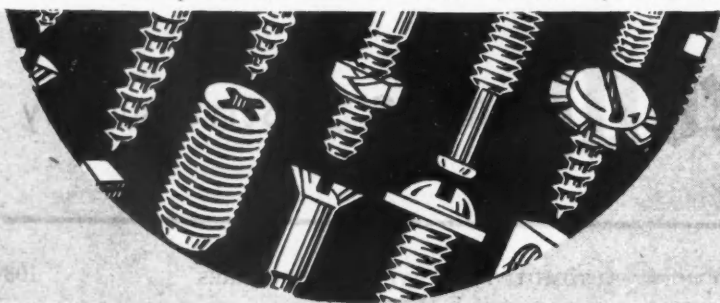
For all present and future fastening needs specify HOLTITE screws, bolts and allied fastenings.

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entire flange by an amount equal to the diameter of this hole. Some form of mounting clip similar to the gusset shown in Fig. 5D is much preferred. In the case of an end cross sill where the combination gusset would project beyond the end of the body, this detail can be handled by first boxing in the zone of attachment with a piece of stub channel as shown in Fig. 5C and then applying the combination gusset to the back of this built in box. This detail is only necessary at the end cross sill. It is especially desirable to have this double reinforcement at the rear end cross sill because this sill usually has to take more load strains than any other sill in the body due to the tail gate and rear door loading conditions and the backing of the unit into loading platforms. A little extra attention at this point is always well worth the effort.

Compulsory Patent Licensing Seen as Threat to Progress

American supremacy in invention and technological progress will be endangered by compulsory licensing of patents as set forth in several bills now pending in Congress, according to R. J. Dearborn, chairman of the committee on patents of the National Association of Manufacturers.

"This country's growth to the status of the world's greatest industrial nation has been due largely to its patent system," said Mr. Dearborn. "Compulsory licensing of patents would strike at the very fundamentals of the system. It would compel the holder of a patent to grant licenses to others to produce his invention and would, in effect, mean a sharing of inventions, which is foreign to our American way of life.

"By forcing an inventor to give up his exclusive rights before he has an opportunity to reap any reward the full incentive which the patent system is intended to give would be largely removed.

"Furthermore, if the patent holder is forced to license to all who may apply he will be unable to obtain risk capital for the commercialization of his invention. Investors are willing to exploit a promising invention largely because of the exclusive rights for 17 years given an inventor by the grant of a patent.

Special importance was attached by NAM to the third report of the National Patent Planning Commission, issued Sept. 6, 1945. This group, headed by Dr. Charles F. Kettering, stated its opposition to compulsory licensing as follows: "That policy and practice would not only nullify the patent owner's proprietorship, but it would also discourage inventiveness and lessen the initiative of investors by exposing them to greater uncertainty and larger risks of the investment of capital requisite to the development and commercialization of new mechanisms and compositions."

AUTOMOTIVE and AVIATION INDUSTRIES



The Bishop Had Drags

and we are not trying to be funny!

IN 1595 Bishop Veranzeo of Dalmatia wrote a book. In it he described the great need for drags in his rugged country. They were really an early form of brakes.

The Bishop's drags were curved poles fastened to the side of a carriage in such a way that the poles would drag against the sides of a pass, as shown above, and be pressed against a rear wheel. Being only good in defiles, they were an ineffective way of braking.

Braking problems are equally tough today — and with high speeds, tremendous engine power and heavy traffic, automotive vehicles require superior brakes.

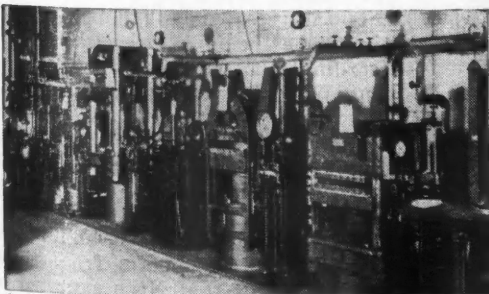
Just "Any" brake lining won't do

Automotive engineers pay so much attention to brake design and construction, due to changing requirements, that they have little time to devote to the actual technicalities of friction material.

That's why American Brakeblok engineers are so frequently called in for consultations on braking problems, particularly on new models while in the blue print stage. Automotive engineers appreciate the informative data and authoritative findings that American Brakeblok engineers have been able to offer. The fact that a large majority of the car and truck manufacturers use American Brakeblok brake lining as original equipment is an excellent recommendation.

Mr. Automobile Manufacturer . . .

here is American Brakeblok, right at your elbow — with an understanding of your problems, with engineers in whom you can have confidence, with a laboratory that is geared to postwar engineering, and with plants that are only a short-haul distance from your own production lines. Why not get in touch with us today?



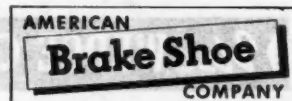
American Brakeblok pilot plant. With this equipment the experimental department makes sample runs of friction materials for use in tests. The equipment duplicates the full scale machines used in production.

American Brakeblok

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November 1, 1945

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American Chain & Cable Co. Acquires New Line

American Chain & Cable Co., Inc., Bridgeport, Conn., has acquired the business of the Certified Gauge and Instrument Corp. of Long Island City, N. Y. The principal product of the latter company is a pressure gage with a new patented mechanism called the Helicoid movement. This gage was developed during the war and is used widely by the Army and Navy. Manufacturing will continue at the Long Island City plant under the name Helicoid Gage Division, American

Chain & Cable Co., Inc. As Helicoid gages are used in the same general fields as two of American Chain & Cable's present lines, Reading-Pratt & Cady valves and d'Este automatic regulating valves, the acquisition of this new line will supplement the company's products for markets it now serves.

Marshall-Eclipse Building New Factory at Troy, N. Y.

A four-fold expansion of plant facilities to meet expected demands for brake linings for postwar passenger

cars and trucks was begun recently by the Marshall-Eclipse division of Bendix Aviation Corp. with the breaking of ground for a new factory at Troy, N. Y.

The new plant, now under construction, will be four times larger than any of the present buildings of the division. It will cost more than \$500,000 and will provide approximately 80,000 sq. ft. of space. One of the two present plants of the division will be remodeled to provide new offices and a much larger research and engineering department. The second plant, now used for manufacturing operations, will be used for storage.

Now! WEDGE ROLLED THREADS on Tubing and Hollow Parts Economical-High Speed Production



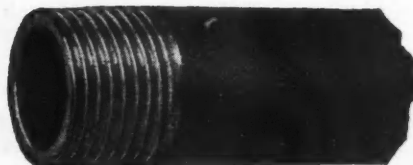
SIZES—1/2" dia. to 6" dia.
Wall Thickness—.020 to 1/4"
Pitch—from 30 pitch x .020 wall to
4 pitch x .062 to 1/4" wall

You are invited to consult our Engineers regarding any threading problem you may have. In most cases where cut threads cannot be used on thin tubing we can roll them successfully.

Michigan Representative
Carl Van Der Heide
6432 Cass Ave., Detroit 2, Mich.
Phone Madison 5300

With the WEDGE process of rolling threads it is possible to supply rolled threads on tube or pipe too thin for cutting threads. Tube and hollow parts can be threaded inside or outside—V, acme, round or square threads. We can roll threads on steel, brass, copper and magnesium tubing of any length.

Our process is based upon a new and exclusive method and is very rapid—production up to 1,000 per hour can be obtained depending upon the size. We can also roll threads on heavy tubing or parts—far more efficiently and cheaper than by present methods. You may submit your threading problems to us. We have reduced costs for many.



Write for further information

WEDGE PROTECTORS, INC.

9540 RICHMOND AVENUE

CLEVELAND 5, OHIO

Use WEDGE Chill Rings-Thread Protectors

Most Companies Producing Cars

(Continued from page 46)

machines. Keller stated that his company would be in full production by six months after V-J day.

Ford Motor Co. reported that it was building more than 400 cars a day and was attempting to get into full production as soon as possible. Henry Ford, II, president, said Ford is expecting to build 75,000 cars and 50,000 trucks yet this year. Branch plants at Edgewater, N. J., Buffalo, Louisville, Dallas, Chicago, and Somerville, are in operation and others are rapidly being whipped into shape to go into production at an early date.

Packard now is in limited production, but is experiencing trouble with shortages of certain components needed to complete the cars. The trouble prevails generally in the industry. When newsmen visited the plant, several cars had been partially assembled, but were waiting for nine items from strikebound suppliers. The principal missing items were body parts. At one time, Packard had one of the largest press shops in the country, but much of the machinery was made available to industry for war work, and is not recoverable. George T. Christopher, president, said the company plans to rebuild its press shop as soon as room is available.

Hudson Motor Car Co., which had been closed for five weeks because of a foremen's strike, was in production Oct. 20 and turning out around 120 cars per day, and a few light trucks. If materials are available, the company will produce between 10,000 and 12,000 units this year, about 10 per cent of this number being commercial vehicles, according to A. E. Barit, Hudson president. When operating at peak capacity with two lines on two shifts, the company will turn out 950 cars a day. Hudson will spend about \$6 million on its reconversion and postwar expansion program.

While Studebaker, Nash, and Willys were not visited, reports from these companies show that Nash expected to get into production about Nov. 1, that Willys has been shut down on production of civilian jeeps by suppliers.

But performance is invisible

THE GLEAMING NEW CARS are things of beauty—as good-looking as they are welcome. But in the long run *performance* counts, and harness-type wiring systems wrapped in VINYLITE plastic tape are far safer and eminently more reliable than older types of assemblies. Made by New England Tape Co., Inc., this unique tape was used on the multiple circuit harnesses of almost every American combat vehicle and service truck—for *eight outstanding reasons*. It is non-flammable and has high dielectric and tensile strengths. Besides exceptional resistance to abrasion, it is virtually unaffected by chemicals, moisture, oils, or grease.

And behind the performance of VINYLITE plastic tape there's an unusual production story. Applied by standard wrapping procedures and heat-sealed by 15-minutes' baking, VINYLITE plastic tape slashes wiring harness

production time from 24 hours to 24 minutes! No varnish is used. No additional baking is required. The old hand-cleaning of terminals is wholly eliminated.

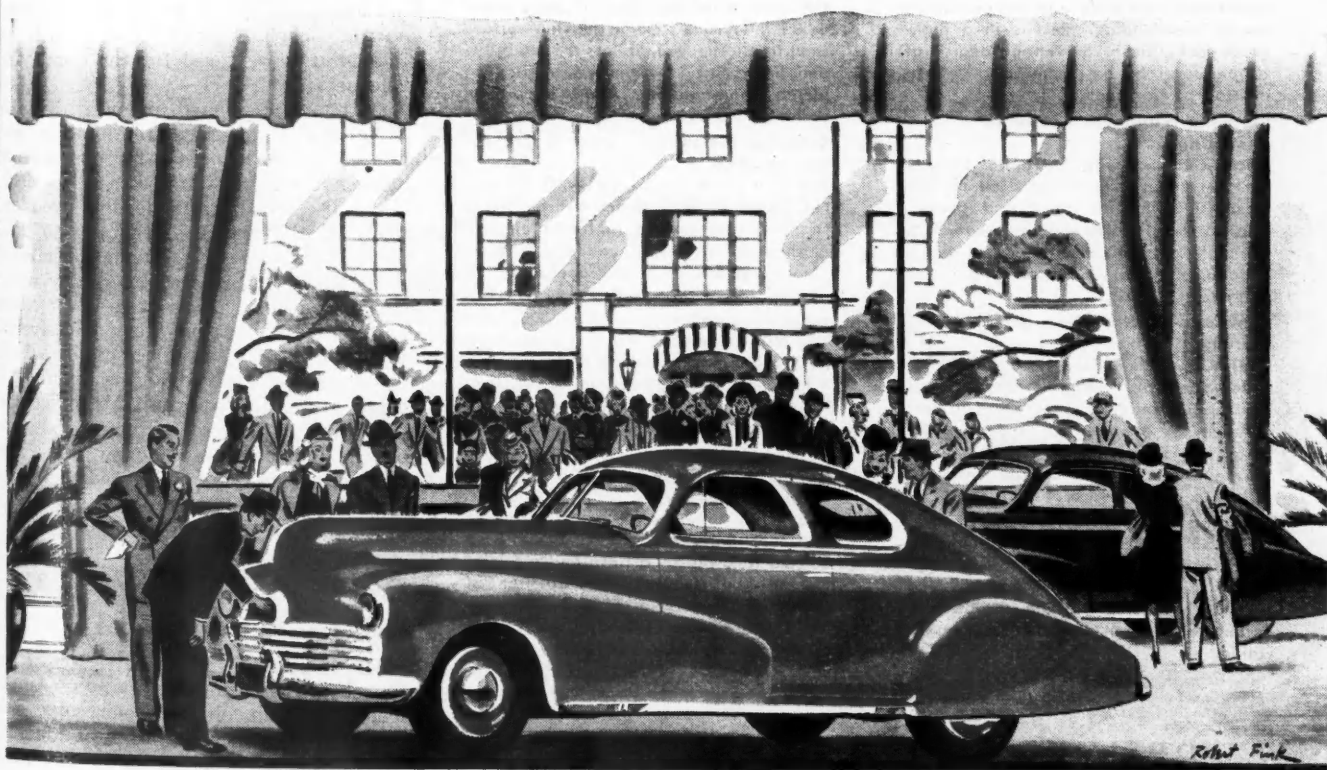
Specify VINYLITE plastic tape as your best assurance of safety, dependability—and economy—in wiring harnesses. VINYLITE plastics are also available as extrusion materials for primary insulation, tubular jacketing, and conduits, and bring new standards of service and service life in automotive applications. Write Department 15-S for Booklet W-4, "VINYLITE Plastics Wire and Cable Insulation," which will be gladly sent upon request.

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November 1, 1945

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strikes but expected to get going again soon, and that Studebaker also was closed for the same reason, but probably is now in production again.

Prices of new cars was a question of prime importance at all companies. General Motors spokesmen said that none of the divisions had yet filed prices at the time of the plant tours. C. E. Wilson, president, said that G.M. would ship cars to its dealers in the hope that by the time all of them are supplied, prices will be set. Otherwise, he said, it might be necessary for the plants to close. To attain the 1936-'39 profit margin allowed by OPA under its

formula, he said, General Motors would have to expand volume 60 per cent, restore prewar labor efficiency, and get overhead, which has increased greatly during the war, back to the prewar level. An increase in wages, currently being sought by the UAW-CIO, is out of the question without an increase in car prices, he added.

Ford Motor Co., which had submitted price lists to OPA, reported that its prices had been returned by OPA for modification. Although Ford did not state how much of an increase had been asked, it was reported to be at least 15 per cent. George Christopher,

Packard president, said his company had submitted an analysis of increased costs to OPA showing an overall increase of 17 per cent. Chrysler had not filed its prices as of Oct. 20, but stated that basic wage rates had increased about 20 per cent over prewar on a weighted basis. Hudson stated that its basic wage rates are up 11 per cent.

According to all company spokesmen, the principal pitfalls to full production are the serious labor situation, with its attendant effect on supplies of parts and the complex and confusing pricing policy of OPA. There was some division of opinion on whether or not the labor problem can be overcome without crippling strikes, but most of the companies believe they are in for considerable labor trouble. The price situation, however, is expected to be straightened out in time to avoid serious trouble.

Shortage of Coke

(Continued from page 46)

ultimate consumers directly. With the same objective in mind, sales to jobbers are also being scrutinized and where it is obvious that a consumer's requirements justify his buying direct from a mill, sales efforts in that direction are initiated. Announcement has been made by OPA that, effective October 16, price control on stainless steels has been suspended. "If an inflationary rise should develop, price control will be immediately restored for the item", the release stated.


Although the law under which the Government may pay premiums to producers of certain non-ferrous metals does not expire until June 30, 1946, there is already considerable wonderment in the metal market as to how prices will shape up when premiums and ceiling prices are done away with. Copper with a ceiling price of 12 cents a pound is moving very slowly at present. The ceiling price of tin, which is 52 cents for Grade A, is around 11 cents under the approximate price the Government pays to Bolivian producers of tin concentrates. A few days ago it was reported and confirmed at Washington that 18,000 tons of tin have been uncovered in Malaya.

Frery Elected to Receive Perkin Medal

Dr. Francis C. Frery, director of research of Aluminum Company of America, has been elected to receive the Perkin Medal in recognition of his outstanding accomplishments in the field of industrial research, according to an announcement by Cyril S. Kimball, secretary of the America Section of the Society of Chemical Industry. The presentation of the medal will take place at a dinner meeting of the society at the Hotel Commodore on the evening of Jan. 11, 1946.

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OPTIMUS Cleaner No. 1A10 handles a wide variety of metals. Cleans steel and non-ferrous metals by either soak or electro-clean, or combination of both. Ideal all-around material for job shop or plating department having a wide variety of metals to clean before plating.

☐ **Cleaning die-castings prior to plating**

OPTIMUS Cleaner No. 101A is ideal as a soak cleaner to treat polished die castings before plating. It cleans completely and leaves a bright surface. Can also be used as an electro-cleaner on the same application.

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☐ **Removing lint, grease, oil and dirt from machinery**

A 5 to 15 minute soak in a solution of OPTIMUS Solvent No. 2 and Stoddard Solvent followed by a rinse and a 5 minute alkaline cleaning in a solution of OPTIMUS Cleaner No. 1A10 followed by hot water rinse and steaming, gives ideal results on very dirty work.

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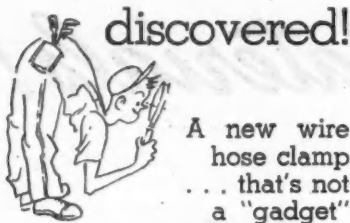
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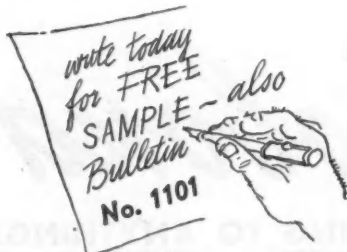
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Air Transport Problems

(Continued from page 50)

centuating improved equipment facilities and procedures.

The importance of flying boats for both military operations and commercial use was emphasized by H. C. Schildhauer, captain, Naval Air Transport Service Command. In advocating the development of the flying boat on a parallel basis with land-based planes, Captain Schildhauer pointed out that both Great Britain and Russia have not curtailed their efforts in this respect. According to Captain Schildhauer, the flying boat is superior in many ways to land-based planes because of its greater safety, ability to land without prepared landing fields, and its long-range potential. Captain Schildhauer further believes that the flying boat is adaptable for transport use. Since it has a higher load-carrying efficiency than land-based planes, it is easily serviced and water terminals for them are more easily and cheaply constructed than are the elaborate airports for land-based planes. In short, he contends that while the flying boat is not a cure-all, it should not be underestimated.

The work of designing standardized Navy cockpits has been initiated, including not only the simplification of instrument arrangement, but also investigations into the utilization of senses other than sight, according to Captain Luis de Florez, assistant chief, Office of Research and Inventions, Navy Department. The redesigned cockpit is "clean" with all edges and corners rounded. The instrument panel is flush, and consideration is being given to a disposable panel containing all light switches. Captain de Florez stated that the work to date marks the completion of only the first phase of a long project, but it is recognized as the basic pattern for simplification and reduction of hazards.

The first session of the meeting was under the chairmanship of A. W. Dallas, director, Engineering Division, Air Transport Association of America. Presiding over the second session was J. Parker Van Zandt, director of aviation research, The Brookings Institution.

GM and GM Acceptance Corp. Win Court Decision

General Motors Corporation and General Motors Acceptance Corp. of Indiana, Inc., have been cleared of charges that they violated the Sherman Anti-trust laws in revoking the franchise of a Pontiac dealer. The United States District Court for the Northern District of Indiana ruled against F. L. Mendez & Co., Inc., South Bend, who had sought to recover triple damages of \$140,000.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 8, 1933

OF AUTOMOTIVE and Aviation INDUSTRIES published semi-monthly at Philadelphia 39, Pa. for October 1, 1945.

State of Pennsylvania } ss.
County of Philadelphia }

Before me, a Notary Public in and for the State and county aforesaid, personally appearing G. C. Buzby, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the AUTOMOTIVE and Aviation INDUSTRIES and that the foregoing is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 8, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Chilton Company, Chestnut and 56th Sts., Philadelphia 39, Pa.; Editor, Julian Chase, 5601 Chestnut St., Philadelphia 39, Pa.; Managing Editor, None; Business Manager G. C. Buzby, East Sunset Ave., Chestnut Hill, Philadelphia 18, Pa.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Chilton Company, Chestnut and 56th Sts., Philadelphia 39, Pa.

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5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is (This information is required from daily publications only.)

G. C. BUZBY, Pres. & Bus. Mgr.

Sworn to and subscribed before me this 17th day of September, 1945.

BESSIE H. GARBEN

(My commission expires January 3, 1946.)
[SEAL.]

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GMC Truck and Coach Expansion Program

Ground has been broken for a new coach assembly plant marking the first step in a modernization and expansion program at the factories of GMC Truck & Coach Division of General Motors in Pontiac, Mich.

The entire program, which will add 1,500,000 square feet of floor space to GMC's present plant facilities, includes an assembly plant for production of GM cruiser-type coaches, an engine plant for manufacture and assembly of GMC engines and a new Engineering Build-

ing for their new experimental work.

Work has already been started on the new coach assembly plant, and it is expected to be completed around Dec. 15, 1945. Work on the other buildings will be pushed as rapidly as possible.

Resistoflex Corp. to Make Vulcanizing Machine

Resistoflex Corp. has acquired the American manufacturing rights for an automatic vulcanizing machine formerly produced by Stenor, Inc., and sold under the trade name of Stenorizer. Renamed the Resistoflex Vulmaster, the machine will be packaged with all

necessary tools and patches and sold as a unit for hot-or-cold-patching of rubber and synthetic rubber tires, tubes, casings and other rubber products. Distribution of these units as well as the machine and patches separately will be handled by Resistoflex Corporation through selected distributors and representatives in all but the New England area and New York State. The main sales office will be located at the parent plant in Belleville, N. J.

Nash Assembly Plant to be Built in Mexico

Negotiations have been completed for the construction of a large assembly plant and the distribution of Nash automobiles and parts in the Republic of Mexico. The new assembly plant, to be known as Construcciones Fabriles, S. A., will be operated by an industrial group in Mexico headed by Col. Lawrence Higgins, who has had 13 years of foreign service with the U. S. Department of State.

The plant will be located at Tlalne-pantla, about 10 miles from the heart of Mexico City, where approximately 70 per cent of all automotive sales in the country are made.

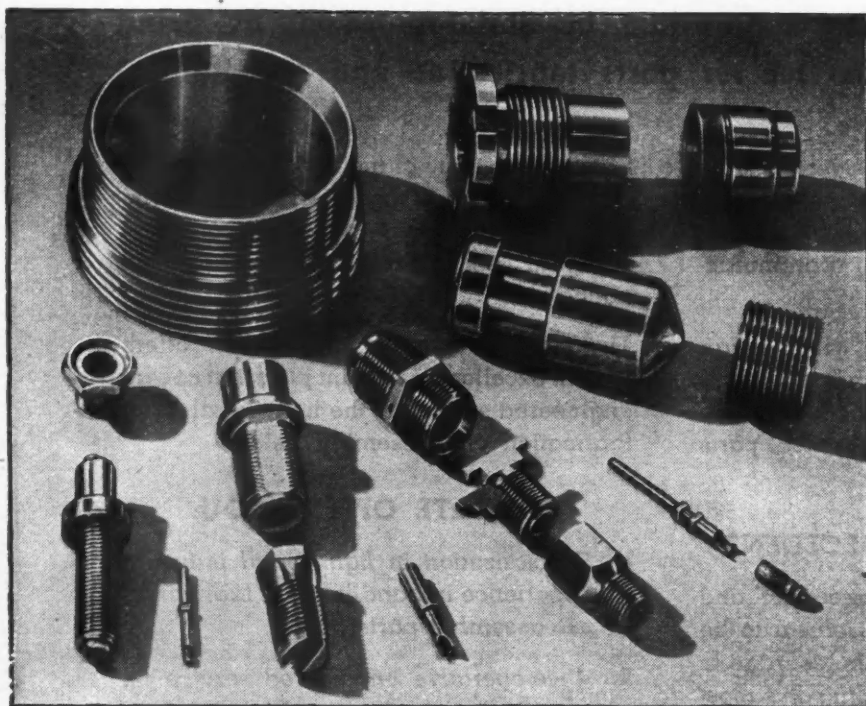
ATSC Sponsors Army Air Forces Fair

(Continued from page 48)

plane. Working with the aircraft industry, ATSC engineers developed the pressurized cabin which permits B-29 crews to fly and fight above flak. They dreamed into reality the counter-rotating propeller which eliminates the effects of torque reaction. From their vision has also come the reversible pitch propeller which, supplemented by rockets for assisted take-offs, will soon make short runways useable by giant airplanes.

Through ATSC's laboratories, shops, giant wind tunnels and test blocks flow not only its own ideas and designs but the best of those from the great minds of industry—both American and British. ATSC guides a team made up of industrial research and engineering talent, the scientific laboratories and engineering staffs of great educational and industrial research institutions and its own highly specialized technical personnel.

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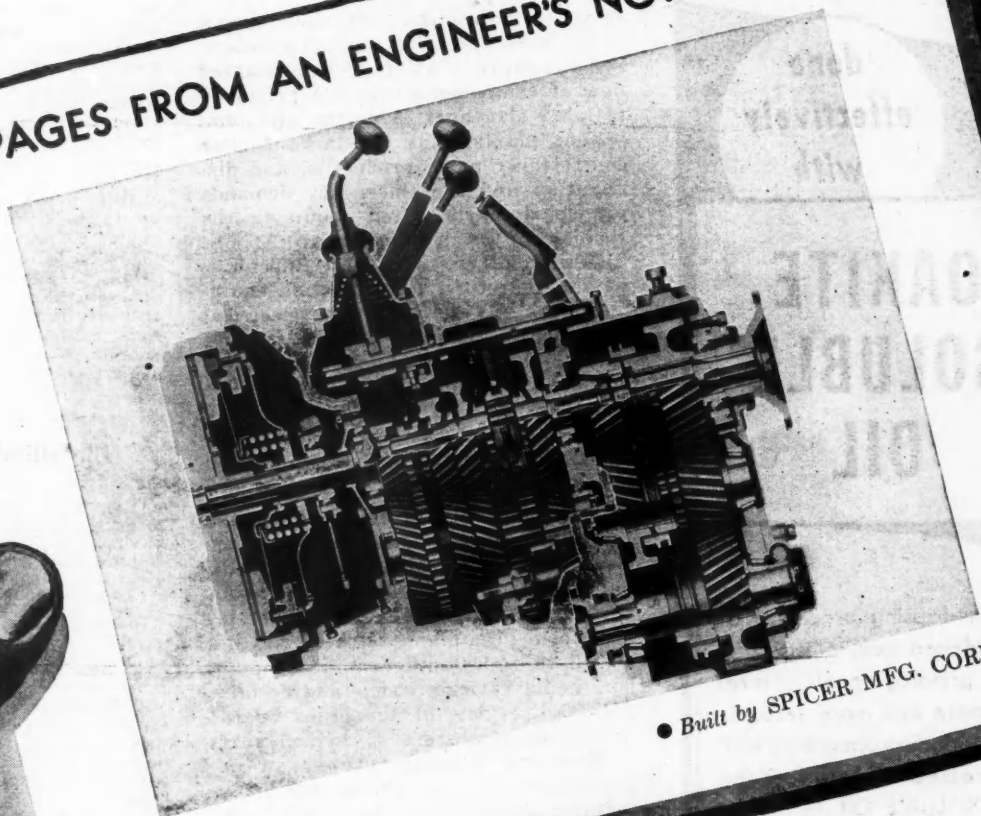


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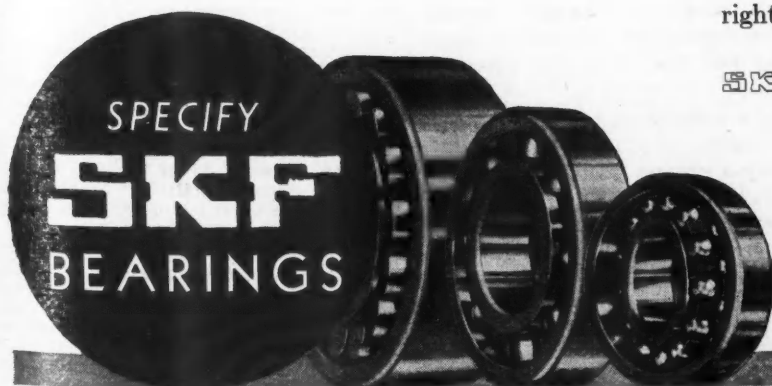
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New Methods Triple Output

(Continued from page 18)

serve to assure that the most urgent needs were met with minimum delays.

The failure to attain a well-balanced flow of components was due primarily to labor shortages in engine and component plants, plus the lack of close control over parts production and distribution and the emergency demands for spare parts, often requiring the robbing of production lines. At one time or another, there were difficulties with carburetors, fuel injection equipment for Diesel engines, electrical equipment, cylinder liners, pistons, valves, ring gears, friction bearings, crankshafts, and many others. The worst problem of all was in engine block and head castings, where labor shortages consistently held production below demand.

The complexity of the problem and the difficulties in scheduling become clear when it is realized that the ordinary automotive-type engine has about 1800 parts; that one of the larger industrial engine manufacturers will use 40,000 to 80,000 different parts numbers in its various models and designs. Thorough review of the order boards of all manufacturers of critical parts at frequent intervals proved an impracticable job; one carburetor manufacturer alone submitted an order board which filled an entire drawer of a standard legal size file cabinet. To assure sequence of deliveries in line with needs, dependence had to be placed on working with the engine producers to spot their shortages, as a basis for expediting action.

When the heavy new spare parts requirements of the Services for the final push of the war began to come in, late in 1944, a special expediting group was set up to supplement the efforts already being devoted to the problem, and this group was given special powers under a special direction to Order M-293. Through the efforts of this group—the Engine Parts Coordinating Office—working in cooperation with the military services, parts production capacity was expanded, closer liaison was established with engine makers and parts producers through special WPB representatives in the plants, and shortages had been largely overcome by V-J Day.

With the coming of peace, the non-captive engine producers find themselves with a greater production capacity than before the war, but it is altogether possible that this expanded capacity can be utilized at a high rate for a considerable length of time. There is a large accumulated civilian demand for these engines, for replacements, and for many types of equipment in which the engines are used.

BOOKS

(Continued from page 82)

BUSINESS EXECUTIVE'S GUIDE, by J. K. Lasser. Pub. Whittlesey House, McGraw-Hill. The gamut of the problems of a business man, whether he runs a small shop or a large corporation, ranging from organization to finance, taxes and management are covered within the covers of this small book. Prepared by the author of "Your Income Tax," "Terminated War Contracts" and other well known writings on business subjects, this is not a text book but a check list or outline in format. It discusses the subject under specific chapter headings such as "Know the Risks of Business," "How to Finance Your Company," "How to Borrow from Your Bank," "How to Control Salesmen's Expenses," "How to Design Your Business Forms," etc., etc. For each chapter heading, the author gives in topical form the pros and cons, advantages of doing it one way or another, with hints as to how each problem has been solved before.

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TO MANUFACTURERS OF HIGH STANDARDING—a ready made efficient high speed sales organization covering all or any part of the Pacific Coast is at your service. For action, address ALAN P. CLINE AND ASSOCIATES, 116 New Montgomery St., San Francisco 5. Manufacturers representatives covering the wholesale Automotive, Hardware and Chain Store trade.

FOR SALE—Brown Holst #10366 with 36" magnet, Engine, 10 H.P. Generator and controls. Good condition. American Silk Mfg. Co., 4341 Orchard St., Philadelphia 24, Pa.

STEEL SHELVING, 18 gauge, large quantities of various sizes, complete with angle irons and uprights. 1 1/4" x 1 1/4" x 1/2" thick. Shelves can be assembled on 3" centers; immediate delivery. Samples of shelf and prices on request. J. E. MURPHY, 2024 Walnut, St. Louis, Mo. Central 5227.